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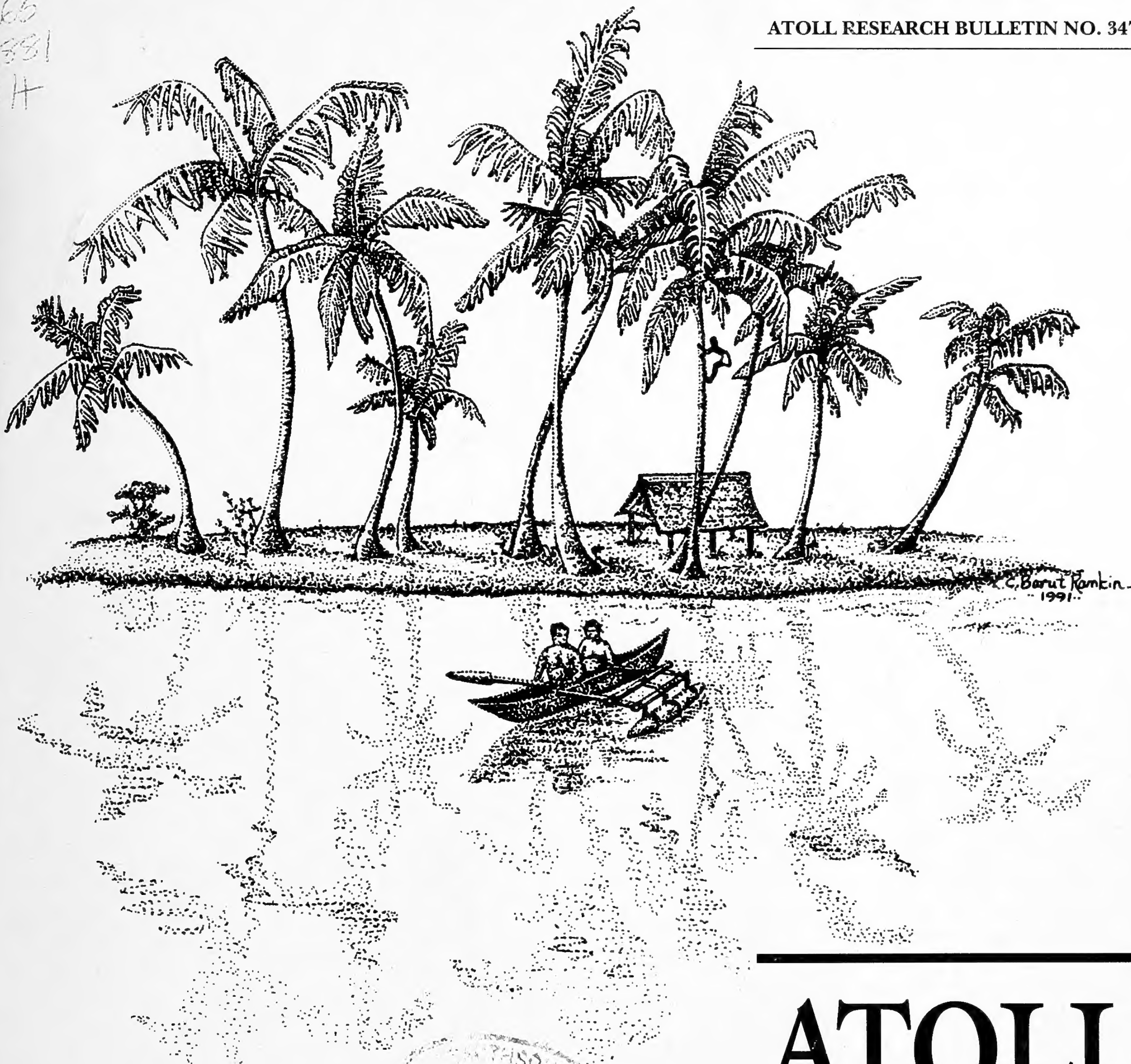

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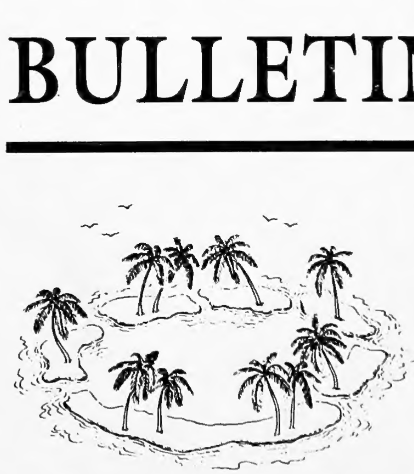

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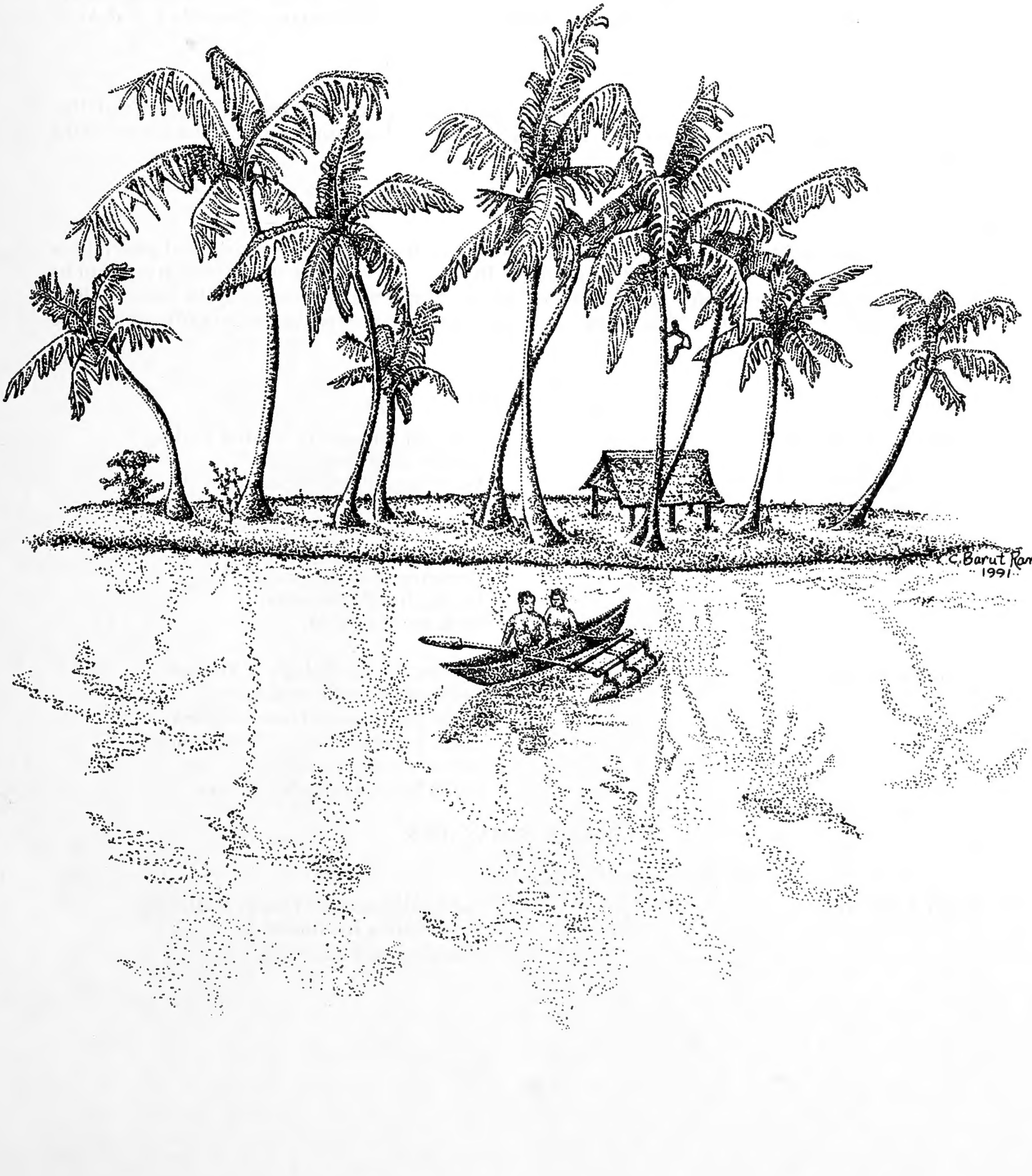
CONTENTS LIST AND INDEXES FOR THE *ATOLL RESEARCH BULLETIN*



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All statements made in papers published in the Atoll Research Bulletin are the sole responsibility of the authors and do not necessarily represent the views of the Smithsonian nor of the editors of the Bulletin.

Articles submitted for publication in the Atoll Research Bulletin should be original papers in a format similar to that found in recent issues of the Bulletin. First drafts of manuscripts should be typewritten double spaced. After the manuscript has been reviewed and accepted, the author will be provided with a page format with which to prepare a single-spaced camera-ready copy of the manuscript.

EDITORS

F. Raymond Fosberg
Mark M. Littler
Ian G.Macintyre
Joshua I. Tracey, Jr.

National Museum of Natural History
Smithsonian Institution
Washington, D. C. 20560

David R. Stoddart

Department of Geography
University of California
Berkeley, CA 94720

Bernard Salvat

Laboratoire de Biologie & Ecologie
Tropicale et Méditerranéenne
Ecole Pratique des Hautes Etudes
Labo. Biologie Marine et Malacologie
Université de Perpignan
66025 Perpignan Cedex, France

BUSINESS MANAGER

Royce L. Oliver

National Museum of Natural History
Smithsonian Institution
Washington, D.C. 20560

ATOLL RESEARCH BULLETIN

NO. 347

CONTENTS LIST AND INDEXES FOR THE ATOLL RESEARCH BULLETIN

BY

Mary McCutcheon

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By: Mary McCutcheon [1]

Introduction

Not counting this issue, there have been 346 numbers in the *Atoll Research Bulletin* and 595 authored contributions. The accumulation of material has made it almost impossible to locate articles pertaining to specific islands or subjects without some sort of search tool. It seemed appropriate at this point to do a comprehensive bibliography and group of indexes which, after 40 years of publication, can also serve as a retrospective of the journal. Upon looking at the indexes, even the editors were amazed to note just how much information there is in the *Atoll Research Bulletin*!

The History of the *Atoll Research Bulletin*

In June, 1946, the United States was preparing for its new role as administrator, under a U.N. Trusteeship agreement, of the large part of the Pacific that had been under Japanese domination before the War. As a way of collecting information, George Peter Murdock and Harold J. Coolidge representing the National Research Council of the National Academy of Science held a conference to discuss the current state of knowledge about Pacific Islands. The participants recommended establishing a Pacific Science Board which would be composed of scientists specializing in a range of fields and geographic areas. It would be dedicated to aiding scientists, advising policy makers, and furthering international cooperation. The Pacific Science Board formally came into existence later that year and remained active until 1969 when Harold Coolidge, its executive director, retired.

The Pacific Science Board was recognized immediately as a valuable research organization. Among the significant projects it sponsored were the Coordinated Investigations of Micronesian Anthropology (CIMA), Scientific Investigations in Micronesia (SIM), Insect Control For Micronesia (ICCM), Scientific Investigation of Ryukyus (SIRI), Pacific Island Rat Ecology (PIRATE), Biological Investigation of Pacific Area (BIPA), and surveys of Indonesia, Malaya,

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In the meantime, the South Pacific Commission under Dr. H.G. MacMillan established project E-6, "Economic Development of Coral Islands," in May 1949. Recognizing the advantages of working in collaboration with the Pacific Science Board, MacMillan requested the Pacific Science Board to set up a survey of coral islands with the object of identifying resources with development potential. The Pacific Science Board agreed and set up the Coral Atoll Program under the umbrella of Scientific Investigations of Micronesia.

In addition to the South Pacific Commission work, the Coral Atoll Program undertook various other projects specifically related to low coral islands. It fostered research on Arno, Ifalik, Onotoa, Kapingamarangi and Raroia, and its participants drafted a handbook for atoll research and a bibliography of coral atolls. To plan this work, the Coral Atoll Program sponsored two symposia in 1951--the first in Washington and the second in Honolulu.

The *Atoll Research Bulletin* was not initially part of the master plan for the Coral Atoll Program. But, following the two coral atoll symposia of early 1951, F. Raymond Fosberg who was affiliated with the Pacific Science Board and a participant at the symposia, had the idea of setting up a mechanism for the disseminating information about coral islands. He wrote a memo entitled "Distribution of Atoll Project Information" (March 30, 1951) in which he said, "In an investigation of the magnitude of the Atoll Project, and involving such a number of people in one way or another, it is obvious that much information must be duplicated and circulated." His concern was twofold: first, that information be disseminated quickly, and second, that there be no bibliographic headaches generated by the production of substantive but informal mimeographed papers. Fosberg mused, "It would be a pity if the Atoll Project were remembered as the source of bibliographic difficulties" and added, "My suggestion as a way of avoiding such difficulties would be to issue a definitely numbered and dated, actually published bulletin of preliminary information, perhaps to be termed the *Atoll Research Bulletin*."

Thus the early numbers of the *Atoll Research Bulletin* were composed mainly of Atoll Project reports: the symposium papers of 1951 (numbers 1 and 2), preliminary research results from the work done on Arno (numbers 3-10), Onotoa (numbers 12-13), Ifalik (numbers 44 and 77), and Raroia (numbers 31-36), and an early draft of the Atoll Research Handbook (number 17).

There was a growing demand, though, for a journal where researchers other than those supported through the Pacific Science Board could submit their articles. Harold Maude, in a 1958 letter, encouraged the Pacific Science Board to branch out into demographics, linguistics, and history, to solicit more articles, and to turn the *Atoll Research Bulletin* into a final publication, not just an interim way of getting timely research results out. He pointed out that for many researchers

"there is no other area journal at all likely to publish the results of their work." Before long the *Atoll Research Bulletin* began to broaden its scope by publishing more articles on atolls in the Indian Ocean and cays in the Caribbean. By 1966 even articles on tropical high islands began to appear.

The first issue of the *Atoll Research Bulletin* was mimeographed and sent to only 300 recipients (individuals, research institutions, and libraries). Now the circulation is almost three times that number with an additional 200 copies going to Federal Repositories.

In the beginning, F. Raymond Fosberg was the official editor, but his assistant at the time, Marie-Hélène Sachet, assumed more and more responsibility over the editing and assembly of the journal. As long as Sachet worked part time at the National Academy of Science, the *Atoll Research Bulletin* was issued by that institution. When she and Ray Fosberg both moved over to the Smithsonian under the auspices of the Tropical Biology Program, the journal followed them. In 1969 David R. Stoddart, then of Cambridge University, became an editor and then in 1979 Ian Macintyre of the Department of Paleobiology in the National Museum of Natural History of the Smithsonian joined the editorial team. Royce Oliver, meanwhile, took over production responsibilities for the journal as the business manager. This continued until 1986 when Marie-Hélène Sachet died. Since then, Ian Macintyre has served as coordinating editor with Royce Oliver continuing as business manager. Meanwhile, a board of editors composed of F. Raymond Fosberg, Mark Littler, Ian Macintyre, Joshua Tracey, David Stoddart, and Bernard Salvat now reviews submissions and maintains high publication standards.

While produced by the National Academy of Science, the *Atoll Research Bulletin* was usually funded by a grant from the Office of Naval Research. Because of the link with the South Pacific Commission, though, René Catala's report on the Gilberts (number 59) was funded by the South Pacific Commission. Since 1966, it has usually been supported by the Director's Office of the Smithsonian Institution's National Museum of Natural History. In some exceptional cases, the U.S. Fish and Wildlife Service has funded numbers pertaining to their Pacific Ocean Biological Survey Program. Recently, though, during these times of budgetary uncertainty, Royce Oliver has has to delve into the Bulletin's own small savings account to pay for production.

The *Atoll Research Bulletin* has always been distributed free of charge to interested people, research organizations and libraries, but over the last 25 years, donations have been solicited as a cushion against the risk of budget cuts. There have been bleak times for the *Atoll Research Bulletin* (including the present time), and the board of editors has been grateful for this little nest egg. This particular issue was funded by a grant from the Atherton Seidell Endowment which provides

funds for making already published information more widely accessible. We are very grateful for their generous support.

The *Atoll Research Bulletin* comes out irregularly with an average of two issues per year. An issue may contain between one and 14 numbers each of which is composed of either one authored work or several papers in an edited collection.

The List of Contents of the *Atoll Research Bulletin*

The first part of this volume (pp 7 to 65) is the contents list in alphabetical order by first author. Those articles which are part of edited works are listed separately. Even appendices and short notes in the "Atoll News and Comment" and "Island News and Comment" sections are included as long as they have by-lines. There are two unauthored works. One is listed under "Anonymous" and the other, which is a list based on the mollusk collections of H.J. Morgan is listed with Morgan as author. "Atoll News and Comment" and "Island News and Comment" are listed under "Editor (Fosberg F.R. and M-H Sachet)".

Each reference has an annotation. Rather than summarizing the conclusion of an article, an annotation is simply a quick description of its contents in incomplete sentences with a list of supplementary material, such as maps, bibliographies, and photographs. It is intended to help a researcher determine whether the article is likely to be helpful for his or her purposes.

The Index Terms

Each article was assigned index terms to allow easy retrieval. The only exceptions are commemorative articles on Marie-Hélène Sachet and certain "Atoll News and Comment" and "Island News and Comment" sections which contain too little information on too many subjects to be really useful to researchers.

These index terms fall into three categories: A) geographic region; B) geologic feature, and C) topic.

A) Most articles pertain to specific islands or island groups. Geographic region index terms were assigned at two levels of abstraction: the more general being nearest continent, ocean or sea (e.g. "Australia", "Pacific" or "Caribbean") and the more specific being the island group and, if given, the specific island (e.g. "Great Barrier Reef, Capricorn Group", "Tuamotus, Raroia" or "Amirantes, Alphonse Island").

B) There are a few articles that discuss geologic features, such as atolls, reefs, high islands, in general without referring to any particular place. These were indexed by the geologic feature.

C) All articles were indexed by the topic at two levels of abstraction: general subject matter (e.g. "Zoology" or "Ecology") and specific topic and taxon, if relevant (e.g. "Insects, Odonata" or "Mangroves"). Often several index terms were assigned to a given article.

Articles were indexed in anticipation of the needs of the user (a fictional composite character who is our image of the typical reader of the *Atoll Research Bulletin*). Even though my policy was to create an index that was generally hierarchical, perfect adherence to this was compromised in cases where I felt it would not have made searches easier. To make an effective search tool, of course, an index to a bibliography has to create artificial groupings of references. It requires some judgment to determine the "best fit" for references and terms. I tried to use index terms that were neither so general they were meaningless nor so specific that the intention of grouping was lost. In the end, as can be seen from the indexes themselves, I practiced some retrofitting to make them most useful.

<u>Index by Location and Topic</u>

Following the alphabetical "Contents of the *Atoll Research Bulletin*" (on page 67) is the first of three indexes. This is for people who are searching primarily for information from a geographic region or a specific island and secondarily for a topic.

<u>Index by Geologic Feature and Topic</u>

The second index (page 97) is designed to accommodate those ARB articles that pertain to geological features globally without reference to a specific location. It includes these types of features followed, secondarily by general and specific topics.

<u>Index by Topic and Location/Geologic Feature</u>

If a researcher is primarily interested in a topic (Pumice scatters, *Acanthaster planci* or Fresh water) then he or she should start with the third index (page 103). Here articles are sorted first by the general and specific topics and then by the geographic region or geologic feature.

Acknowledgments

A great many people helped to put this issue together.

Thanks go to F. Raymond Fosberg of the Botany Department, National Museum of Natural History and to Janice Goldblum and her staff in the National Academy of Sciences archives for information and recollections about the history of the journal.

Royce Oliver and Ian Macintyre solved production problems, and Constance Barut Rankin and Mary Parrish applied their graphics design skills to the introductory pages of each section. Warren L. Wagner and Laurence Skog of the Department of Botany gave support and guidance.

For help with plant and animal systematics and much other substantive advice, I thank Barrett Brooks, Stephen Cairns, Michael Carleton, Roger Clapp, Ray Fosberg, Suzanne Fredericq, Diane Littler, Mark Littler, Ian Macintyre, Ray Manning, Gustav Paulay, Warren Steiner, and Joshua Tracey.

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Abbott, Isabella A.

1961. A Check List of Marine Algae from Ifaluk Atoll, Caroline Islands. *A.R.B.* No. 77:1-5.
Checklist of marine algae collected from Ifalik (Micronesia) by Donald P. Abbott in 1953. Bibliography.

Adams, C. C.

1969. A Botanical Description of Big Pelican Cay, a Little Known Island off the South Coast of Jamaica. *A.R.B.* No. 130:1-10.
General description and vegetation of Big Pelican Cay off south coast of Jamaica. Map, bibliography, and photographs.

Adey, Walter H.

1975. The Algal Ridges and Coral Reefs of St. Croix. *A.R.B.* No. 187:1-67.
Analysis of cores drilled through St. Croix's algal ridges for paleoecological study. Results of C14 dating and identification of algae responsible for ridge building. Charts, diagrams, maps, photographs, and bibliography.

Adey, Walter, Patricia Adey, Randolph Burke and Leslie Kaufman

1977. The Holocene Reef Systems of Eastern Martinique, French West Indies. *A.R.B.* No. 218:1-40.
Description of reefs and colonies of fleshy algae of Martinique. Discussion of whole reef ecosystem (fish, benthic algae, coral) and environmental determinants of fleshy algae abundance. Bibliography, maps, diagrams, tables.

Allen, Melinda

1989. Artifacts from 1987 Excavations on Henderson Island. *A.R.B.* No. 325:15-18.
Description of artifacts (fishhooks, modified shells, coral cobbles, and a coral abrader (?)) found in cave sites on Henderson Island (Pitcairn Group, Southeastern Pacific). Illustrations.

Amerson, A. Binion

1969. Ornithology of the Marshall and Gilbert Islands. *A.R.B.* No. 127:1-348.
Summary of environmental and geographic conditions on 50 atolls in the Marshall and Gilbert Islands with bird lists for each. History of ornithological explorations. Analysis of bird distribution. Annotated sea bird list. Maps, tables, and bibliography.

1971. The Natural History of French Frigate Shoals, Northwestern Hawaiian Islands. *A.R.B.* No. 150:1-383.
History of French Frigate Shoals (Leeward Islands of the Hawaiian chain). Vegetation, terrestrial fauna, and description of individual islands. Emphasis on bird species. Bibliography and list of scientific collections made.

Amerson, A. Binion, Roger B. Clapp and William O. Wirtz

1974. The Natural History of Pearl and Hermes Reef, Northwestern Hawaiian Islands. *A.R.B.* No. 174:1-306.
General description of Pearl and Hermes Reefs including geology, climate, history, vegetation, and terrestrial vertebrates (especially birds). Reference to the endangered Laysan Duck (*Anas laysanensis*). Photographs, charts, and bibliography.

Amerson, A. Binion and K. C. Emerson

1971. Records of Mallophaga from Pacific Birds. *A.R.B.* No. 146:1-30.
List of Mallophaga parasites on bird hosts from the central Pacific with list of birds and their locations.

Amerson, A. Binion and Philip Shelton

1976. The Natural History of Johnston Atoll, Central Pacific Ocean. *A.R.B.* No. 192:1-479.

Physical environment, history, and biota of Johnston Island with plant and animal lists. Special mention of ciguatera in fishes and detailed description of avifauna and nesting behavior. Photographs, charts and bibliography.

Anderson, Donald

1951. The Plants of Arno Atoll, Marshall Islands. *A.R.B.* No. 7:1-4.

List of flora of Arno Atoll with native names of vascular terrestrial plants.

Anonymous

1987. Tributes to Marie-Hélène Sachet. *In* Introduction to Marie-Hélène Sachet Commemorative. Issue. *A.R.B.* No. 293:8-10.

Antonius, Arnfried

1972. Hurricane Laura, Witnessed in British Honduras. *In* Island News and Comment. *A.R.B.* No. 162:11-12.

Account of effects of Hurricane Laura (1971) in British Honduras (Belize).

Antonius, Arnfried, Georg Scheer, and Claude Bouchon

1990. Corals of the Eastern Red Sea. *A.R.B.* No. 334:1-22.

Analysis of coral collections from all parts and depths of the Red Sea. Description of coral ecosystems in Red Sea and each collecting site. Systematic list of species collected. Map, bibliography.

Apfelbaum, Steven I., James P. Ludwig and Catherine E. Ludwig

1983. Ecological Problems Associated with Disruption of Dune Vegetation Dynamics by *Casuarina equisetifolia* L. at Sand Island, Midway Atoll. *A.R.B.* No. 261:1-19.

Account of undesirable consequences of the introduction of *Casuarina* on Midway Atoll (Leeward islands in the Hawaiian chain). Discussion of *Casuarina* ecology. Charts, graphs, bibliography, plant list.

Arnow, Ted

1954. The Hydrology of the Northern Marshall Islands. *A.R.B.* No. 30:1-7.

Description of climate, tides and water supplies for Arno Atoll. Graphs, bibliography, charts.

1955. The Hydrology of Ifalik Atoll, Western Caroline Islands. *A.R.B.* No. 44:1-15.

General description of Ifalik (Micronesia) including climate and tides. Specific discussion of fresh water from rain and ground with chemical analyses. Charts, maps, and bibliography.

Askew, R. R.

1980. The Insect Fauna of Little Cayman. *In* Stoddart and Giglioli (editors) Geography and Ecology of Little Cayman. *A.R.B.* No. 241:97-114.

Preliminary analysis of insects collected from Little Cayman (Caribbean) and description of general characteristics of insect fauna. Chart and bibliography.

1980. *Odonata*, of the Cayman Islands. *In* Stoddart and Giglioli (editors) Geography and Ecology of Little Cayman. *A.R.B.* No. 241:115-120.

Dragonflies observed on Little Cayman Island (Caribbean). Bibliography.

1980. The Butterfly (Lepidoptera, Rhopalocera) Fauna of the Cayman Islands. *In* Stoddart and Giglioli (editors) Geography and Ecology of Little Cayman. *A.R.B.* No. 241:121-138.

Butterflies observed on Little Cayman Island (Caribbean) and comparisons with nearby islands. Bibliography, maps and graphs.

Askew, R. R. (cont)

1980. Hawkmoths (Lepidoptera, Sphingidae) of Little Cayman. *In* Stoddart and Giglioli (editors) Geography and Ecology of Little Cayman. *A.R.B.* No. 241:139-140.

Short list of hawkmoths known for Little Cayman Island (Caribbean). Bibliography.

Bakus, Gerald J.

1975. Marine Zonation and Ecology of Cocos Island, off Central America. *A.R.B.* No. 179:1-8.

Description of underwater biotic zones on the leeward side of Cocos Island (Costa Rica). Bibliography and photographs.

Bakus, Gerald J. (editor)

1972. Marine Studies on the North Coast of Jamaica. *A.R.B.* No. 152:1-6.

Abstracts of papers on marine biology of the north coast of Jamaica by students in an Organization for Tropical Studies (OTS) course on tropical marine biology. Bibliography.

Balazs, George H.

1975. Marine Turtles in the Phoenix Islands. *A.R.B.* No. 184:1-7.

Observations of marine turtles on Canton Island (Central Pacific): their status, their nesting behavior and predators. Bibliography and map.

Balazs, George H.

1983. Sea Turtles and Their Traditional Usage in Tokelau. *A.R.B.* No. 279:1-30.

Status, ecology and human usage of sea turtles at the three Polynesian atolls of Tokelau. Goal to work with local people to promote conservation. Maps, photographs, and bibliography.

Balazs, George H.

1985. Status and Ecology of Marine Turtles at Johnston Atoll. *A.R.B.* No. 285:1-46.

Documentation of available information on marine turtles on Johnston Atoll (northeastern Pacific) and results of a short- term tagging study. Maps, tables, bibliography.

Banner, Albert H.

1961. Submarine Effects of the Typhoon. *In* Blumenstock (editor) A Report on Typhoon Effects Upon Jaluit Atoll. *A.R.B.* No. 75:75-78.

Effects of typhoon Ophelia on the reefs of Jaluit (Marshall Islands).

Banner, Albert H., Judd C. Nevenzel and Webster R. Hudgins

1969. Marine Toxins from the Pacific II. The Contamination of Wake Island Lagoon. *A.R.B.* No. 122:1-9.

Narrative of infestation of Wake Island lagoon with noxious smelling, toxic substance on June 20, 1965. Results of lab analyses and speculations of cause. Bibliography, photographs, and tables.

Banner, Albert H. and John E. Randall

1952. Preliminary Report on Marine Biology Study, Onotoa Atoll, Gilbert Islands. *A.R.B.* No. 13:1-62.

Ecology of Onotoa's (Kiribati) windward and lagoon reefs. Gilbertese use of and names for marine invertebrates. Study of fish. Maps.

Barrett, Kimball L. and Ralph W. Schreiber

1988. The Birds of Bikini Atoll, Marshall Islands: May 1986. *A.R.B.* No. 314:1-46.

Observations of birds on Bikini with recommendations concerning future monitoring, radioactive clean-up, and conservation. Species list, maps, bibliography, charts.

Battistini, R. and G. Cremers, G.

1972. Geomorphology and Vegetation of Iles Glorieuses. *A.R.B.* No. 159:1-10.

Geomorphology, botanical history, vegetation, and flora of Grande Glorieuse and Ile du Lys (Indian Ocean). Bibliography, maps, diagrams, and photographs.

Battistini, R. and C. Jouannic

1979. Recherches sur la Géomorphologie de l'Atoll Farquhar (Archipel des Seychelles). *A.R.B.* No. 230:1-20.

History, general description, and geomorphology of Farquhar Atoll in the Seychelles with mention of the large lagoon embankments and alignments which make Farquhar so unusual. In French. Maps, graphs, photographs, and bibliography.

Battistini, R. and M. Petit

1979. Récifs Coralliens, Constructions Alguaires, et Arrécifes à la Guadeloupe, Marie Galante et la Désirade. *A.R.B.* No. 234:1-7.

Short inventory of reefs of Guadeloupe and its two dependencies, Marie Galante and Désirade. Description of reef morphology and identification of unique features. In French. Maps, charts and bibliography.

Bayne, C.J., B.H. Cogan, A.W. Diamond, J. Frazier, P. Grubb, A. Hutson, M.E.D. Poore, David R. Stoddart and J.D. Taylor

1970. Geography and Ecology of Cosmoledo Atoll. *In* Stoddart (editor) Coral Islands of the Western Indian Ocean. *A.R.B.* No. 136:37-56.

History of scientific research on Cosmoledo. Description of geomorphology, vegetation, fauna, and human settlement. Bibliography and map.

Bayne, C.J., B.H. Cogan, A.W. Diamond, J. Frazier, P. Grubb, A. Hutson, M.E.D. Poore, David R. Stoddart and J.D. Taylor

1970. Geography and Ecology of Astove. *In* Stoddart (editor) Coral Islands of the Western Indian Ocean. *A.R.B.* No. 136:83-100.

History of scientific research on Astove. Descriptions of island geomorphology, vegetation, fauna, and human settlements. Map and bibliography.

Benson, A. A., J. S. Patton and S. Abraham

1978. Energy Exchange in Coral Reef Ecosystems. *In* Smith (editor) Coral Reef Ecosystems: Proceedings of Papers Presented at the 13th Pacific Science Congress, Vancouver. *A.R.B.* No. 220:33-54.

Study of the wax accumulation in corals with mention of coral feeders such as *Acanthaster* and of commensal relationships with coral. Bibliography.

Benson, C. W.

1967. The Birds of Aldabra and Their Status. *A.R.B.* No. 118:62-111.

Systematic list of land and sea birds of Aldabra (Western Indian Ocean). Bibliography.

1970. Land (including shore) Birds of Cosmoledo. *In* Stoddart (editor) Coral Islands of the Western Indian Ocean. *A.R.B.* No. 136:67-82.

Extensively annotated list of land and shore birds of Cosmoledo. Bibliography.

1970. Land (including shore) Birds of Astove. *In* Stoddart (editor) Coral Islands of the Western Indian Ocean. *A.R.B.* No. 136:115-120.

List of land and shore birds of Astove. Bibliography.

Benson, C. W. (cont)

1970. An Introduction of *Streptopelia picturata* into the Amirantes. *In* Stoddart (editor) Coral Islands of the Western Indian Ocean. *A.R.B.* No. 136:195-196.

Observation of the introduced Malagasy turtledove on St. Joseph Atoll in the Amirantes. Bibliography.

1972. Some Land Bird Migrants in the Western Indian Ocean. *In* Island News and Comment. *A.R.B.* No. 162:10-11.

Account of sighting of *Phylloscopus* species on African Banks. Two other migrants also mentioned.

Benson, C. W., H. H. Beamish, C. Jouanin, J. Salvan and G. E. Watson

1975. The Birds of Iles Glorieuses. *A.R.B.* No. 176:1-34.

Detailed annotated list of birds observed in the Iles Glorieuses (Gloriosa in the Western Indian Ocean). Maps and bibliography.

Birkeland, Charles

1981. *Acanthaster* in the Cultures of High Islands. *A.R.B.* No. 255:55-59.

Occurrence of Acanthaster in traditional history, folklore and cultures of high islands of Polynesia, Micronesia and Melanesia. Speculation that *Acanthaster* outbreaks are nothing new. Native names and bibliography.

Blackmore, S.

1981. Penetration of Host Plant Tissues by the Stylets of the Coccoid *Icerya seychellarum* (Coccoidea: Margaroidea) on Aldabra Atoll. *A.R.B.* No. 255:33-38.

Microscopic study of the path of penetration of stylets of *Icerya seychellarum* through tissues of host plants on Aldabra (Western Indian Ocean). Bibliography.

Blumenstock, David I.

1961. Wind, Wave, and Storm Conditions at Jaluit, January 7-8, 1958. *In* Blumenstock (editor) A Report on the Typhoon Effects Upon Jaluit Atoll. *A.R.B.* No. 75:5-20.

Native accounts of Typhoon Ophelia on Jaluit. Reconstruction of events and summary of evidence. Maps.

Blumenstock, David I. (editor)

1961. A Report on Typhoon Effects Upon Jaluit Atoll. *A.R.B.* No. 75:1-105.

Documentation of wind, wave, and storm conditions at Jaluit in the Marshall Islands 1/7-8/1958 (Typhoon Ophelia) with accounts by natives. Charts and map.

Blumenstock, David I. Daniel F. Rex and Irwin E. Lane

1960. Microclimatic Observations at Eniwetok with a Special Section on Vegetation. *A.R.B.* No. 71:1-158.

Data on climate of Enewetak (Marshall Islands) including hydrography, topography, vegetation and detailed charts of meteorological conditions. Maps and photographs.

Bourne, W. R. P.

1971. The birds of the Chagos Group, Indian Ocean. *In* Stoddart and Taylor (editors) Geography and Ecology of Diego Garcia Atoll, Chagos Archipelago. *A.R.B.* No. 149:175-207.

Description of each island in Chagos group. Notes on species of birds found regularly and occasionally there with observation that Chagos group may already have experienced decline in bird populations and diversity. Bibliography.

1981. Rats as Avian Predators: Discussion. *A.R.B.* No. 255:69-72.

Response to F.I. Norman (ARB #182) on subject of rat's role as an avian predator. Examples of extermination of birds by rats on Amsterdam Island, New Zealand, Bermuda, and British Isles.

Boyden, Alan

1953. Collecting Serological Samples. *A.R.B.* No. 17:96-99.

How to collect serological samples from various animals for the Serological Museum at Rutgers University. How to make serological collections without specialized equipment.

Brooke, R. K.

1981. Layard's Bird Hunting Visit to Tromelin or Sandy Island in December 1856. *A.R.B.* No. 255:73-82.

Observations made by Edgar Leopold Layard (1856) on bird breeding habits in Southern Indian Ocean. Eight page passage taken from his published notebook. Bibliography.

Brown, B. E., M. C. Holley, L. Sya'rani and M. le Tissier

1983. Coral Assemblages of Reef Flats Around Pulau Pari, Thousand Islands, Indonesia. *A.R.B.* No. 281:1-14.

Comparison of distribution of corals among the sheltered southern reefs and the exposed northern reefs around Pulau Pari in Indonesia. Tables, map and bibliography.

Bruce, A. J.

1977. The Hosts of the Coral-Associated Indo-West-Pacific Pontoniine Shrimps. *A.R.B.* No. 205:1-19.

Description of the association between shrimps of the subfamily Pontoniinae and Scleractinian corals in the Indo-West Pacific region. Bibliography.

1981. Pontoniine Shrimps of Heron Island. *A.R.B.* No. 245:1-33.

Annotated systematic list of shrimp in the subfamily Pontoniinae from Heron Island of the Great Barrier Reef. Discussion of commensal associations with other marine invertebrates. Charts and bibliography.

Bryan, E. H.

1951. Coral Atoll Bibliography. *A.R.B.* No. 2:14.

Importance, scope and progress of atoll bibliography. No bibliography included.

1953. Intoduction to the Geography of Atolls. *A.R.B.* No. 17:1-9.

Summary of features of coral atolls and theories of their formation. List of geographic subjects in need of investigation. Bibliography.

1953. Check List of Atolls. *A.R.B.* No. 19:1-38.

List of islands that qualify as "atolls" according to Coral Atoll Symposium (1951) definition. Includes synonymous names, longitudes and latitudes, informative notes, and references to U.S. Hydrographic Office charts.

1959. Notes on the Geography and Natural History of Wake Island. *A.R.B.* No. 66:1-22.

Summary of observations made of Wake Island (North Pacific) through history. Notes on rats and pest control (by Fosberg). List of land and freshwater vertebrates. Bibliography.

Buckley, Ralf

1985. Vegetation and Flora of the Lowendal Islands, Western Australia. *A.R.B.* No. 292:75-82.

Botanical observations from islands off Western Australian coast. Maps, species lists, bibliography.

Buddemeier, R. W.

1978. Sclerochronology: A Data Source for Reef Systems Models. *In* Smith (editor) Coral Reef Ecosystems: Proceedings of Papers Presented at the 13th Pacific Science Congress, Vancouver. *A.R.B.* No. 220:25-32.

Investigation of the extent to which scleractinian coral growth patterns may provide useful data for modelling efforts in coral-reef ecosystems. Bibliography.

Buggeln, Richard G.

1965. A Preliminary List of the Algal Flora of the Midway Islands. *A.R.B.* No. 109:1-11.

Annotated list of marine algae collected from Eastern and Sand Islands making up the Midway Islands (Leeward Islands of the Hawaiian chain). Bibliography.

Buggeln, Richard G. and Roy T. Tsuda

1969. A Record of Benthic Marine Algae from Johnston Atoll. *A.R.B.* No. 120:1-20.

Annotated list of marine benthic algae from Johnston Atoll (north central Pacific). Bibliography.

Bussing, William A.

1972. Recolonization of a Population of Supratidal Fishes at Eniwetok Atoll, Marshall Islands. *A.R.B.* No. 154:1-4.

Pattern of recolonization of fish at Enewetak Island of Enewetak Atoll (Marshall Islands) to ascertain rate and manner of succession. Charts and bibliography.

Butler, George D. and Robert L. Usinger

1963. Insects and Other Invertebrates from Laysan Island. *A.R.B.* No. 98:1-30.

Annotated list of insects and other arthropods found on Laysan (Leeward Islands of the Hawaiian chain). Discussion of relationships between birds and arthropods (ectoparasites) and between plants and insects. Description of lake ecology. Bibliography.

Byrne, Roger

1980. Man and the Variable Vulnerability of Island Life: A Study of Recent Vegetation Change in the Bahamas. *A.R.B.* No. 240:1-200.

Study of the impact of human settlement and introductions on the vegetation of Cat Island in the Bahamas. Photographs, maps, charts, systematic plant list, and bibliography.

Carroll, Dorothy [with John C. Hathaway]

1965. Laboratory Examination of Unconsolidated Sediments. *In* Fosberg and Carroll (editors) Terrestrial Sediments and Soils of the Northern Marshall Islands. *A.R.B.* No. 113:31-42.

Study of beach sands and soils from Northern Marshalls: size, biotic composition, mineral composition (by John C. Hathaway). Photographs, maps, graphs, and charts.

Carroll, Vern

1964. Place Names on Nukuoro Atoll. *A.R.B.* No. 107:1-11.

Nukuoro (Polynesian outlier in Micronesia) native concepts of geography and island classes -- including man-made islands. Local place names and their etymologies.

Catala, René L. A.

1957. Report on the Gilbert Islands: Some Aspects of Human Ecology. *A.R.B.* No. 59:1-187.

Description of subsistence, resource use, agriculture, insects, and general human ecology of Onotoa in the Gilberts. Includes recommendations for economic development. Gilbertese vocabular, bibliography, photographs, illustrations, charts.

Cheke, A. S. and J. C. Lawley,

1983. Biological History of Agalega, with Special Reference to Birds and Other Land Vertebrates. *In* Sachet, Stoddart, and Fosberg (editors) Floristics and Ecology of Western Indian Ocean Islands. *A.R.B.* No. 273:65-108.

Exploration and study of Agalega, geologic history, climate, vegetation, list of land vertebrates and sea turtles with comments on past observations and present status. Introduction and disappearance of coconut crabs. Bibliography and photographs.

Child, Peter

1960. Birds of the Gilbert and Ellice Islands Colony. *A.R.B.* No. 74:1-38.

Lists of resident and migratory birds in the Gilbert and Ellice Islands. List of trees commonly associated with birds. Bibliography.

Chock, Alvin K. and Dean C. Hamilton

1962. Plants of Christmas Island. *A.R.B.* No. 90:1-7.

Checklist of plants found on Christmas Island (central Pacific). Short history of island, map and bibliography.

Clapp, Roger B.

1972. The Natural History of Gardner Pinnacles, Northwestern Hawaiian Islands. *A.R.B.* No. 163:1-25.

General description of Gardner Pinnacles with emphasis on geology, botany, and vertebrate fauna. Maps, bibliography, and photographs

1977. Notes on the Vertebrate Fauna of Tongareva Atoll. *A.R.B.* No. 198:.1-7.

Notes on reptiles and mammals of Tongareva Atoll (central Pacific) with more extensive annotated species list of birds. Bibliography.

1987. Status of the Red-Footed Booby Colony on Little Cayman Island. *A.R.B.* No. 304:1-15.

Description of the colony of red-footed boobies on Little Cayman (Caribbean). Recommendations for its protection. Photographs, bibliography, maps, tables.

1990. Notes on the Birds of Kwajalein Atoll, Marshall Islands. *A.R.B.* No. 342:1-94.

Survey of birds from several islets in Kwajalein Atoll. Description of islets and detailed annotated bird list. Recommendation that bird populations on Legan, Enewetak and Gellinam islets be protected. Bibliography, photographs, map and tables.

Clapp, Roger B. and Eugene Kridler

1977. The Natural History of Necker Island, Northwestern Hawaiian Islands. *A.R.B.* No. 206:1-102.

Geology, history, prehistory, vegetation (by Derral Herbst), birds, reptiles, near-shore mammals of Necker Island. Photographs and bibliography.

Clapp, Roger B., Eugene Kridler and Robert R. Fleet

1977. The Natural History of Nihoa Island, Northwestern Hawaiian Islands. *A.R.B.* No. 207:1-147.

Geology, history, prehistory, vegetation (by Derral Herbst), birds, reptiles, near-shore mammals of Nihoa Island. Reference to endangered Nihoa millerbird (*Acrocephalus familiaris*) and Nihoa Finch (*Telespyza ultima*). Photographs and bibliography.

Clapp, Roger B. and Fred C. Sibley

1971. The Vascular Flora and Terrestrial Vertebrates of Vostok Island, South-Central Pacific. *A.R.B.* No. 144:1-9.

Observations of vascular plants, fish, reptiles, birds, mammals, and avian ectoparasites from Vostok in the Line Islands. Map, bibliography, and photographs.

1971. Notes on the Vascular Flora and Terrestrial Vertebrates of Caroline Atoll Southern Line Islands. *A.R.B.* No. 145:1-18.

Observations of vascular plants, fish, reptiles, birds, mammals, and avian ectoparasites from Caroline Atoll in the Southern Line Islands. Map, bibliography, and photographs.

Clapp, Roger B. and William O. Wirtz

1975. The Natural History of Lisianski Island, Northwestern Hawaiian Islands. *A.R.B.* No. 186:1-196.

General description, geology, history, vegetation and fauna of Lisianski (Leeward Islands of Hawaiian chain). Detailed discussion of birds and their behavior. Bibliography, photographs, and tables.

Clark, A. M. and J. D. Taylor

1971. Echinoderms from Diego Garcia. *In* Stoddart and Taylor (editors) Geography and Ecology of Diego Garcia Atoll, Chagos Archipelago. *A.R.B.* No. 149:89-92.

Annotated list of echinoderms from Diego Garcia. Bibliography.

Clay, Horace F.

1961. Narrative Report of Botanical Field Work on Kure Islands, 3 October 1959 to 9 October 1959. *A.R.B.* No. 78:1-4.

List of plants found on Kure atoll (mainly Green Island) during 1959 Navy survey (Leeward islands of Hawaiian chain) to build albatross "runways". Aerial photos before and after runway construction.

Cloud, Preston E.

1952. Preliminary Report on Geology and Marine Environments of Onotoa Atoll, Gilbert Islands. *A.R.B.* No. 12:1-73.

Geology and biology of Onotoa lagoon with discussions of beachrock, coral, hydrology, and atoll formation. Bibliography.

Clough, Barrett C. and George Fulk

1971. The Vertebrate Fauna and the Vegetation of East Plana Cay, Bahama Islands. *A.R.B.* No. 138:1-17.

General characteristics of East Plana Cay in the Bahamas. Description of lizards, birds, vegetation, and the rodent, *Geocapromys ingrahami*. Bibliography and photographs.

Coblentz, Bruce E. and Dirk Van Vuren

1987. Effects of Feral Goats (*Capra hircus*) on Aldabra Atoll. *A.R.B.* No. 306:1-6.

History of goat introductions on oceanic islands and comments on the ensuing extinctions and destruction of native vegetation. Bibliography.

Coblentz, Bruce E., Dirk Van Vuren, and Martin B. Main

1990. Control of Feral Goats on Aldabra Atoll. *A.R.B.* No. 337:1-10.

Discussion of harmful role of feral goats on Aldabra, recommendation of extermination, discussion of ecological dominance of feral goats and history of their establishment in the Seychelles. Bibliography, map, charts.

Cohic, F.

1959. Report on a Visit to the Chesterfield Islands, September 1957. *A.R.B.* No. 63:1-11.

Description of history, vegetation, flora, and fauna of the Chesterfield Islands. maps and bibliography.

Connor, Judith and Walter H. Adey

1977. The Benthic Algal Composition, Standing Crop, and Productivity of a Caribbean Algal Ridge. *A.R.B.* No. 211:1-15.

Description of algal ridges off St. Croix with estimates of reef productivity. Lists of algae species. Bibliography, maps, tables, and graphs.

Coolidge, Harold J.

1951. Introduction. *A.R.B.* No. 1:2-5.

Introduction to the Coral Atoll Project (Pacific Science Board of the National Research Council) and Research Project E6 (South Pacific Commission). List of participants in Arno pilot project and summary of economic development options on atolls.

Cortés, Jorge

1990. The Coral Reefs of Golfo Dulce, Costa Rica: Distribution and Community Structure. *A.R.B.* No. 344:1-37.

Description of Golfo Dulce on Costa Rica's Pacific coast comparing deteriorating inner gulf reefs with healthy outer gulf reefs. Difference explained by tectonics and siltation due to deforestation and poor land use. Bibliography, photographs, map.

Cox, Doak C.

1951. The Hydrology of Arno Atoll, Marshall Islands. *A.R.B.* No. 8:1-31.

Description of climate, tides, rain catchment and ground water of Ine Islet, Arno Atoll. Illustrations, sections, graphs.

1953. Hydrology. *A.R.B.* No. 17:24-37.

Ways of estimating the mean head, salinity, hardness, and density of fresh ground water on atolls. Based on experience on Arno.

Cox, Doak, Dan A. Davis and Chester K. Wentworth

1951. Geology and Ground Water of Atolls. *A.R.B.* No. 2:3-4.

Importance of geologic research and study of ground water on atolls. Summary of main data needs.

Crocombe, R. G.

1961. Land Tenure in the Cook Islands. *In* Doran (editor) Land Tenure in the Pacific. *A.R.B.* No. 85:55-60.

Social, and political aspects of indigenous land tenure of Cook Islands. Comments on the 1961 situation and agrarian reform.

Crombie, Ronald I., David W. Steadman and John C. Barber

1983. A Preliminary Survey of the Vertebrates of Cabarita Island, St. Mary Parish, Jamaica. *A.R.B.* No. 280:1-12.

Survey of vertebrate fauna of Cabarita Island off Jamaica to investigate degree of endemism and rate of destruction of fauna on a small island in the Antilles. Annotated list of terrestrial vertebrates. Bibliography, photographs, and map.

Cubit, John and Suelynn Williams

1983. The Invertebrates of Galeta Reef (Caribbean Panama): A Species List and Bibliography. *A.R.B.* No. 269:1-45.

List of species of invertebrates found off Caribbean Panama. Map, diagram, bibliography.

D'Arcy, W. G.

1971. The Island of Anegada and its Flora. *A.R.B.* No. 139:1-21.

General description of Anegada, British Virgin Islands. Vegetation and check list of flora. Bibliography, photographs, and maps.

1975. Anegada Island: Vegetation and Flora. *A.R.B.* No. 188:1-40.

Physical description, vegetation, and check list of plants of Anegada, Virgin Islands. Map and bibliography.

Dahl, Arthur L.

1978. Spatial Modelling of Coral Reefs. *In* Smith (editor) Coral Reef Ecosystems: Proceedings of Papers Presented at the 13th Pacific Science Congress, Vancouver. *A.R.B.* No. 220:13-20.

Analysis of the spatial arrangement of component parts of coral reefs with intention to link such a physical structure model to models of energy and material flows. Bibliography.

Dahl, Arthur L., Ian G. Macintyre and Arnfried Antonius

1974. A Comparative Survey of Coral Reef Research Sites. *In* Sachet and Dahl (editors) Comparative Investigations of Tropical Reef Ecosystems: Background for an Integrated Coral Reef Program.
A.R.B. No. 172:38-120.

Brief comparison of coral reef regions in the Caribbean and Pacific in order to choose the optimum research site. Maps, diagrams, and bibliography.

Dahl, Arthur L., B. C. Patten, S. V. Smith and J. C. Zieman

1974. A Preliminary Coral Reef Ecosystem Model. *In* Sachet and Dahl (editors) Comparative Investigations of Tropical Reef Ecosystems: Background for an Integrated Coral Reef Program. *A.R.B.* No. 172:7-37.

Attempt to design a computer model of a coral reef ecosystem. Bibliography and diagrams.

Dana, Thomas F.

1979. Species Numbers Relationships in an Assemblage of Reef-Building Corals: McKean Island, Phoenix Islands. *A.R.B.* No. 228:1-27.

Investigation of species-numbers relationships in the McKean Island assemblage of reef-building corals to discover how they changed along environmental gradients of the reef. Bibliography, lists of coral species, charts, graphs, and photographs.

Danielsson, Bengt and Aurora Natua

1954. Raroian Culture. *A.R.B.* No. 32:1-109.

Five parts: Economy of Raroia, Native topographical terms, native coconut palm terms, bird names (coauthored by Aurora Natua), and check list of native names of fishes. Sections on demography, land tenure, subsistence, labor. Bibliography, maps, charts.

Darwin, Charles (with editorial comments by David R. Stoddart)

1962. Coral Islands. *A.R.B.* No. 88:1-20.

Introduction, map and remarks by David Stoddart. Excerpts relating to theories of coral island origins taken from such sources as Darwin's autobiography, The Structure and Distribution of Coral Reefs, and Journal and Researches: 1832-1836. Bibliography.

Dawson, E. Yale

1959. Some Marine Algae from Canton Atoll. *A.R.B.* No. 65:1-6.

Annotated list of marine algae (green, brown, and red algae) from Canton. Bibliography.

DeFilipps, Robert A.

1987. A Bibliography of Plant Conservation in the Pacific Islands: Endangered Species, Habitat Conversion, Introduced Biota. *A.R.B.* No. 311:1-195.

Annotated bibliography of plant conservation with indices by subject and geographic region. map.

DeFilipps, Robert A., Shirley L. Maina and Leslie A. Pray

1988. The Palauan and Yap Medicinal Plant Studies of Masayoshi Okabe, 1941-1943. *A.R.B.* No. 317:1-25.

Edited translation of Masayoshi Okabe's work on Palauan and Yapese medicinal plants with biographical information about Okabe and a review of other literature pertaining to medicinal flora of Palau and Yap. Plant lists and bibliography.

Degener, Otto and Isa Degener

1959. Canton Island, South Pacific (Resurvey of 1958). *A.R.B.* No. 64:1-24.

Resurvey of plants of Canton Island following introduction of exotics. Description of climate and soils, and list of plants observed. Bibliography.

Degener, Otto and Edwin Gillaspy

1955. Canton Island, South Pacific. *A.R.B.* No. 41:1-51.

Results of a survey of Canton for purposes of planning the revegetation of areas effected by human activity. Description of climate, topography, history, land and aquatic flora, and land fauna. Recommendation of importing plant species.

Delesalle, B. and colleagues

1985. Environmental Survey of Mataiva Atoll, Tuamotu Archipelago, French Polynesia. *A.R.B.* No. 286:1-34.

Explanation of the partitioning of lagoons on Mataiva as a result of alternating subsidence and uplifting in geologic history. Description of hydrological environment and ecology of the distinct pools. Bibliography, species lists, figures, photographs.

Devaney, Dennis M. and John E. Randall

1973. Investigations of *Acanthaster planci* of Southeastern Polynesia during 1970-1971. *A.R.B.* No. 169:1-21.

Survey for *Acanthaster planci* in Tuamotus, Gambier Group, Pitcairn Group, Rapa, The Australs, the Cooks, the Society Islands, the Marquesas and American Samoa. Charts, photographs, and maps.

Diamond, A. W.

1980. Ecology and Species Turnover of the Birds of Little Cayman. *In* Stoddart and Giglioli (editors) Geography and Ecology of Little Cayman. *A.R.B.* No. 241:141-164.

Description and systematic list of avifauna in Cayman Islands, Little Cayman in particular. Discussion of habitat and breeding behavior and need for conservation. Bibliography.

1980. The Red-footed Booby Colony on Little Cayman: Size, Structure and Significance. *In* Stoddart and Giglioli (editors) Geography and Ecology of Little Cayman. *A.R.B.* No. 241:165-170.

Size of population and distribution of Red Footed Boobies (*Sula sula*) on Little Cayman. Possible ecological implications of economic development on booby habitats. Map, charts, and bibliography.

Diamond, E. P.

1981. An Early Report of the Flora and Fauna of the Aldabra Group. *A.R.B.* No. 255:1-10.

Summary of report made by Sgt. F. Rivers in 1878 which sheds light on changes on islands in the Aldabra Group over 100 years. Bibliography.

DiSalvo, Louis H.

1972. Bacterial Counts in Surface Open Waters of Eniwetok Atoll, Marshall Islands. *A.R.B.* No. 151:1-3.

Bacterial counts for samples from coral reefs of Enewetak Atoll. Charts and bibliography.

Domm, S. B.

1971. The Uninhabited Cays of the Capricorn Group, Great Barrier Reef, Australia. *A.R.B.* No. 142:1-27.

Description of unihabited cays of the Capricorn Group on the Great Barrier Reef with special attention to birds and human interference. Bibliography and photographs.

1971. The Safe Use of Open Boats in the Coral Reef Environment. *A.R.B.* No. 143:1-10.

How to navigate around the Great Barrier Reef. The choice of the proper boat and guidelines to gauging tides, reef access, water depth, and bearings.

1971. Mapping Reefs and Cays, a Quick Method for the Scientist Working Alone Island News and Comment. *A.R.B.* No. 148:15-17.

How to map reefs and cays with minimal equipment, time, and manpower.

Domm, Steven and John Messersmith

1990. Feral Cat Eradication on a Barrier Reef Island, Australia. *A.R.B.* No. 338:1-4.

Predation by feral cats on wedge-tailed shearwaters on North West Island, Great Barrier Reef. Generally harmful role of cats in relation to defenseless birds. Description of eradication of cats from North West Island. Bibliography.

Donaldson, A. and B. A. Whitton

1977. Chemistry of Freshwater Pools on Aldabra. *A.R.B.* No. 213:1-25.

Analysis of fresh water in pools on Aldabra from 1972-1973 with discussion of the unusually high levels of dissolved phosphate and ammonia-N in the water. Bibliography, photographs, and tables.

1977. Algal Flora of Freshwater Habitats on Aldabra. *A.R.B.* No. 215:1-18.

List of algae in freshwater pools on Aldabra with observations on distribution of species, seasonality, habitat adaptation, and grazing by planktonic animals. Bibliography and chart.

Doran, Edwin

1960. Report on Tarawa Atoll, Gilbert Islands. *A.R.B.* No. 72:1-54.

Summary of living conditions -- environmental, social, political, medical, etc. -- on Tarawa in the Gilberts. Appendices, photographs.

1961. Gilbert Islands Landscape. *In* Doran (editor) Land Tenure in the Pacific. *A.R.B.* No. 85:5-8.

Description of rainfall, vegetation, population, and atoll land mass of Gilbert Islands and Tarawa, in particular. Suggests that rainfall limits food production and hence population, but cannot demonstrate this statistically. Table, maps.

1961. Marshall Islands Landscape. *In* Doran (editor) Land Tenure in the Pacific. *A.R.B.* No. 85:11-16.

Comparison of Gilberts and Marshalls with discussion of land tenure and tenure of lagoons and marine resources. Maps.

1961. Malaita Island Landscape. *In* Doran (editor) Land Tenure in the Pacific. *A.R.B.* No. 85:25-26.

Climate, population, agricultural conditions on the high island of Malaita. Contrast with atolls. Maps.

1961. Fiji Islands Landscape. *In* Doran (editor) Land Tenure in the Pacific. *A.R.B.* No. 85:33-34.

Precipitation and population of Fiji. Maps.

Doran, Edwin (cont)

1961. Tonga Islands Landscape. *In* Doran (editor) Land Tenure in the Pacific. *A.R.B.* No. 85:43-44.

Temperature and vegetation of Tonga. Maps.

1961. Cook Islands Landscape. *In* Doran (editor) Land Tenure in the Pacific. *A.R.B.* No. 85:51-54.

Description of Cook Islands, precipitation, population distribution, comparative note on the interrelationship between physical landscape, the configuration of land parcels and population density. Maps.

Doran, Edwin (editor)

1961. Land Tenure in the Pacific. *A.R.B.* No. 85:1-60.

Papers presented at the 10th Pacific Science Congress Symposium. Attempt to limit study areas to non-Westernized islands with representation from the entire Pacific. 12 papers, 6 localities. Map.

Doty, Maxwell S.

1953. Instructions for Collecting Algae. *A.R.B.* No. 17:62.

Types of algae it is most important to collect. How to preserve and ship algae.

1954. Floristic and Ecological Notes on Raroia. *A.R.B.* No. 33:1-41.

Floristic and ecological notes on Myxophyta, Mycophyta, Lichens, Algae, and Spermatophyta of Raroia. Key to vascular plants and descriptions of their habitats. map.

Doty, Maxwell S. and J. P. E. Morrison

1954. Interrelationships of the Organisms on Raroia Aside from Man. *A.R.B.* No. 35:1-61.

Comparison of six transect profiles from Raroia to derive data on organisms and ecological zones. Maps, transect diagrams, and aerial photo.

Drew, Edward A.

1977. A Photographic Survey Down the Seaward Reef-front of Aldabra Atoll. *A.R.B.* No. 193:1-7.

Description of photographic transect method to study reef- front of Aldabra Atoll. Charts, maps, diagrams, photographs, and bibliography.

Dunne, R. P. and B. E. Brown

1979. Some Aspects of the Ecology of Reefs Surrounding Anegada, British Virgin Islands. *A.R.B.* No. 236:1-80.

Description, history, geology, and reef structure of Anegada. List of algae, coral, and fish inhabiting coral reefs with discussion of reef zonation. Photographs, maps, charts, and 4 bibliographies.

Dustan, Phillip

1985. Community Structure of Reef-Building Corals in the Florida Keys: Carysfort Reef, Key Largo and Long Key Reef, Dry Tortugas. *A.R.B.* No. 288:1-17.

Line transects reveal the species composition and zonation patterns of two coral communities off the Florida Keys which have been exposed to different environmental and biological pressures – especially prevailing ocean currents. Photographs and figures.

Easton, W. H.

1981. A Submersible, Rechargeable, Electric Drill. *A.R.B.* No. 255:83-90.

Model for a light weight, cordless, rechargeable, electric hand drill mounted in a submersible plastic case to use for setting survey points or taking core samples. Bibliography.

Editors [Fosberg, F.R. and M.-H. Sachet]

1959. Atoll News and Comment. *A.R.B.* No. 70:1-7.
News of recent expeditions and publications.

1961. Atoll News and Comments. *A.R.B.* No. 84:1-14.
Recent and current research on Christmas Island, the Leeward Hawaiian Islands, Midway, Wake, Jaluit, Caroline Islands, Laccadives, Alacran Reef, atolls off British Honduras, and Rongelap (Report on vegetation by Blumberg and Conard). Recent literature.

1962. Atoll News and Comments. *A.R.B.* No. 94:1-19.
Atomic bomb tests on Christmas. Contents of Bulletin of the Christmas I. Natural History Society. Account of shipwreck on Clipperton. Book review of Herold J. Wiens, Atoll Environment and Ecology. Bibliographic and research news.

1963. Atoll News and Comments. *A.R.B.* No. 100:1-16.
News of expeditions to the Society Islands, Melanesian atolls, the Phoenix Islands, Christmas Island, Wake, the Leeward Hawaiian Islands, the Gilbert and Ellice Islands, and the Caroline Islands. Announcements of new books.

1964. Atoll News and Comment. *A.R.B.* No. 108:1-8.
News about the displaced island communities study, the Pacific Ocean Biological Survey Program's research on sea birds, research in the Line Islands, the Caroline Islands, the Maldives, and the Bahamas. New publications reviews.

1965. Atoll News and Comment. *A.R.B.* No. 112:1-14.
News of Sea bird survey (Pacific Ocean Biological Survey Program), research on Enewetak, the Tokelaus, the Maldives, the Bahamas, Jamaica, and the British Honduras cays. New publications reviews.

1967. Atoll News and Comments. *A.R.B.* No. 117:1-8.
Report on the demise of Unesco Humid Tropics Research Program, field work in the Carolines and the Persian Gulf. Recent publications.

1969. Atoll Notes and Comments. *A.R.B.* No. 119:1-6.
News of current research in the Caroline Islands and on Islands in the Indian Ocean, especially Diego Garcia. Short research notes on Heron Island rats by F.I. Norman (with bibliography). Reviews of recent publications.

1969. Atoll News and Comment. *A.R.B.* No. 126:1-19.
News on expeditions to Albabra, Christmas Island (Indian Ocean), Clipperton, British Honduras, Rennell and Bellona, and Bikini. Honors to E.H. Bryan and research reports by Keith Marshall and Andrew Goudie. Recent publications.

1970. Atoll News and Comments. *A.R.B.* No. 135:1-17.
News of conservation programs and symposia, nuclear tests, anthropological research, *Acanthaster* reports, and recent publications.

1971. Island News and Comment. *A.R.B.* No. 148:1-38.
News about research on Aldabra, bomb tests in the Tuamotus, C14 dates from Ifalik, Research on environmental systems of Enewetak, Research on coral reefs off the east coast of New Guinea, and studies of birds of the Comoros.

1972. Island News and Comment. *A.R.B.* No. 162:1-26.
News of current research, conservation progress, symposia, laboratories and publications.

1975. Island News and Comments. *A.R.B.* No. 185:1-39.
News of the Special Working Committee on South Pacific Coral Reefs, News of the Atoll Populations Conference, and book reviews. Short papers by WR. Taylor, C.B. Frith, and I.G. Macintyre.

Editors [Fosberg, F.R. and M.-H. Sachet] (cont)

1977. Island News and Comment. *A.R.B.* No. 219:1-30.

News of 3rd international Coral Reef Symposium, Mid-Pacific Marine Lab, and Phoenix Island Expedition. Comment on definition of "Atoll" and shameful events surrounding Line Islands Expedition.

Ellison, Joanna C.

1990. Vegetation and Floristics of the Tongatapu Outliers. *A.R.B.* No. 332:1-36.

Identification of species of terrestrial flora, description of vegetation units and geomorphological features from 21 small islands in Tongatapu outliers. Discussion of factors effecting floristic variability. Bibliography, maps, charts, photographs.

Ely, Charles A. and Roger B. Clapp

1973. The Natural History of Laysan Island, Northwestern Hawaiian Islands. *A.R.B.* No. 171:1-361.

General description of Laysan Island with emphasis on terrestrial vertebrates. Reference to endangered Laysan duck (*Anas laysanensis*) and Laysan finch (*Telespyza cantans*). Photographs and bibliography.

Emery, Kenneth O.

1953. Beachrock. *A.R.B.* No. 17:19.

Theories concerning the origin of beachrock.

1953. Submarine Geology. *A.R.B.* No. 17:20-21.

Submarine geology research problems that can be addressed with makeshift equipment: steepness of outer slopes, depth of lagoon terrace, mapping coral masses, nature of lagoonal sediments.

Emory, Kenneth P.

1953. Investigation of Material Culture. *A.R.B.* No. 17:122.

How to collect artifacts and information on manufacture and preparation on atolls. Review of scarce literature.

Endean, R. and W. Stablum

1973. A Study of Some Aspects of the Crown-of-Thorns Starfish (*Acanthaster planci*) Infestations of Reefs of Australia's Great Barrier Reef. *A.R.B.* No. 167:1-62.

Description of distribution of *Acanthaster planci* in coral reefs and documentation of spread and population increase on the Great Barrier Reef. Bibliography.

1973. The Apparent Extent of Recovery of Reefs of Australia's Great Barrier Reef Devastated by the Crown-of-Thorns Starfish. *A.R.B.* No. 168:1-26.

Revisit 4 to 8 years after *Acanthaster planci* plague on Great Barrier Reef to monitor the rate and manner of reef recovery. Charts, photographs, and bibliography.

Enders, Robert K.

1951. Rats. *A.R.B.* No. 1:20.

Concern that *R. mindanensis* and *R. norvegicus* get onto coral atolls.

Engbring, John

1983. Avifauna of the Southwest Islands of Palau. *A.R.B.* No. 267:1-22.

Description of the SW Islands of Palau. List of 47 species of birds recorded there with comments on their habitats and ecology. Bibliography.

Falanruw, M. V. C

1971. Conservation in Micronesia. *In* Island News and Comment. *A.R.B.* No. 148:18-20.

The importance of implementing a conservation policy for Micronesia

Farrell, Terence M., Christopher F. D'Elia, Lawrence Lubbers and Lawrence Pastor

1983. Hermatypic Coral Diversity and Reef Zonation at Cayos Arcas, Campeche, Gulf of Mexico. *A.R.B.* No. 270:1-7.

Study of coral reefs in Campeche Bank region reveal greater diversity of scleractinian coral and fewer calcareous algae than expected. Description of reef zonation, bibliography, diagrams, maps, photographs.

Faure, Gérard

1977. Annotated Check List of Corals in the Mascarene Archipelago, Indian Ocean. *A.R.B.* No. 203:1-25.

Annotated check list including 135 species of coral known to come from the Mascarene Archipelago (Reunion, Mauritius, and Rodriguez Islands). Bibliography.

1977. Annotated Check List of Octocorallia in the Mascarene Archipelago, Indian Ocean. *A.R.B.* No. 204:1-13.

Annotated check list including 112 species of Octocorallia known to come from the Mascarene Archipelago (Reunion, Mauritius, and Rodriguez Islands). Bibliography.

Feare, Christopher J.

1979. Ecology of Bird Island, Seychelles. *A.R.B.* No. 226:1-29.

Recent history, climate, geomorphology, vegetation, invertebrate and vertebrate fauna of Bird Island in the Seychelles. Bird lists, maps, photographs, and bibliography.

1979. Ecological Observations on African Banks, Amirantes. *A.R.B.* No. 227:1-7.

Vegetation and fauna of African Banks, Amirantes. Bird list and bibliography.

Flanigan, John M. and Austin E. Lamberts

1981. *Acanthaster* as a Recurring Phenomenon in Samoan History. *A.R.B.* No. 255:59-62.

Occurrence of *Acanthaster* in traditional history of Samoa as evidence that outbreaks there are nothing new. Bibliography.

Flood, P. G.

1977. Coral Cays of the Capricorn and Bunker Groups, Great Barrier Reef Province, Australia. *A.R.B.* No. 195:1-7.

Description of the islands in the Capricorn and Bunker groups of the Great Barrier Reef with explanations for morphological changes. Bibliography, maps, and photographs.

Folk, Robert L. and Augustus S. Cotera

1971. Carbonate Sand Cays of Alacran Reef, Yucatan, Mexico: Sediments. *A.R.B.* No. 137:1-16.

Analysis of beach sediments from Alacran Reef, Yucatan, Mexico including grain size distribution, composition and roundness of sediments from six of the cays. Map, graphs, photographs, and bibliography.

Forbes-Watson, A. D.

1969. Notes on Birds Observed in the Comoros on Behalf of the Smithsonian Institution. *A.R.B.* No. 128:1-23.

Lists of birds recorded from the Comoros with notes on individual species. Reference to endangered Madagascar Heron (*Ardea humbloti*) and Grand Comoro Drongo (*Dicrurus fuscipennis*). Suggestions for further focussed work.

Fosberg, F. Raymond

1951. Ecological Research on Coral Atolls. *A.R.B.* No. 1:6-8.

The significance of Coral Atoll research.

Fosberg, F. Raymond (cont)

1951. Flora and Vegetation on Coral Atolls. *A.R.B.* No. 1:13-14.
The current state of knowledge about vascular plants, bryophytes, soil flora, and marine algae from coral atolls.

1951. Literature on Coral Atolls. *A.R.B.* No. 1:23-25.
Efforts to produce bibliographies of Coral Atolls. Credit to M-H Sachet, W.M. Davis.

1951. Land Ecology of Coral Atolls. *A.R.B.* No. 2:7-11.
Outline of history of ecological research on atolls, outstanding characteristics of the atoll habitat, and processes that altered this habitat.

1953. Directions for Studying Vegetation and Flora. *A.R.B.* No. 17:44-56.
Basic classification of typical atoll plant communities and how to describe an island's vegetation. How to prepare various types of herbarium specimens. Information to accompany collections of economic plants. List of equipment for plant collections.

1953. Vegetation of Central Pacific Atolls, A Brief Summary. *A.R.B.* No. 23:1-25.
Description of Central Pacific atoll habitat, colonization by plants, succession and vegetational changes due to various causes, principal types and patterns of vegetation, and recommendations for future studies. Bibliography.

1955. Northern Marshall Islands Expedition, 1951-1952. Narrative. *A.R.B.* No. 38:1-37.
Narrative of two trips to the Northern Marshall Islands. collection documentation, maps, itinerary.

1955. Northern Marshall Islands Expedition, 1951-1952. Land Biota: Vascular Plants. *A.R.B.* No. 39:1-22.
Documentation of plant collections from Northern Marshall Islands. Marshallese plant names.

1957. Slicks on Ocean Surface Downwind from Coral Reefs. *A.R.B.* No. 53:1-4.
Description of narrow elongate strips of smooth water suggesting a film of something extending downwind from coral reefs. Noted from Ujae, Wotho, and Bikar. Bibliography.

1957. The Maldive Islands, Indian Ocean. *A.R.B.* No. 58:1-37.
Brief report on a trip to Malé Atoll of the Maldives in 1956 with summary of the history of scientific research and a systematic list of plants found there.

1959. Long-term Effects of Radioactive Fallout on Plants?. *A.R.B.* No. 61:1-11.
Observations of abnormal appearances of plants exposed to radioactive fallout following atmospheric bomb tests in the Marshalls. Chart, bibliography.

1959. Vegetation and Flora of Wake Island. *A.R.B.* No. 67:1-20.
Description of climate, soils, vegetation, and flora of Wake. Comparison with 1953 observations. Bibliography.

1959. Additional Records of Phanerogams from the Northern Marshall Islands. *A.R.B.* No. 68:1-9.
List of phanerogams from the Northern Marshalls with unannotated list of cultivated plants from a nursery.

1961. Soils. *In* Blumenstock (editor) A Report on Typhoon Effects Upon Jaluit Atoll. *A.R.B.* No. 75:47-50.
The erosion of the soils on Jaluit as a result of Typhoon Ophelia.

1961. Flora and Vegetation. *In* Blumenstock (editor) A Report on Typhoon Effects Upon Jaluit Atoll. *A.R.B.* No. 75:51-56.
Damage to vegetation as a result of typhoon Ophelia and quick recovery.

Fosberg, F. Raymond (cont)

1961. Typhoon Effects on Individual Species of Plants. *In* Blumenstock (editor) A Report on Typhoon Effects Upon Jaluit Atoll. *A.R.B.* No. 75:57-68.
Systematic list of species of plants on Jaluit and their specific responses to typhoon Ophelia.

1961. Table of Plant Species by Islets. *In* Blumenstock (editor) A Report on Typhoon Effects Upon Jaluit Atoll. *A.R.B.* No. 75:95-104.
Species of plants known from Jaluit by islets as reported since 1946. In table form.

1961. Qualitative Description of the Coral Atoll Ecosystem. *A.R.B.* No. 81:1-11.
Description of coral atoll ecosystem in terms of energy and material transfer or transformation, with minimal reference to actual organisms. Bibliography.

1961. Description of Heron Island. *A.R.B.* No. 82:1-4.
General description of Heron Island on the Great Barrier Reef with special reference to vegetation. Map.

1962. A Brief Survey of the Cays of Arrecife Alacran, A Mexican Atoll. *A.R.B.* No. 93:1-25.
Description of Alacran. Tabular chart of plants observed by botanists on 4 islets showing past vegetation changes. List of flowering plants, terrestrial vertebrates and insects. Comparison of Alacran and Pokak in the Marshalls. Bibliography, charts.

1965. Introduction. *In* Fosberg and Carroll (editors) Terrestrial Sediments and Soils of the Northern Marshall Islands. *A.R.B.* No. 113:1-6.
General physical description of Northern Marshall atolls, climate, tides, cross-sections.

1965. Geology. *In* Fosberg and Carroll (editors) Terrestrial Sediments and Soils of the Northern Marshall Islands. *A.R.B.* No. 113:7-20.
Description of reefs, lagoons and islets in Northern Marshalls. Special discussion of reef development, beachrock and marginal ridges. Diagrams and photographs.

1966. Northern Marshall Islands Land Biota: Birds. *A.R.B.* No. 114:1-35.
Descriptions of Wake and Islands of the Northern Marshalls. Report of birds observed.

1969. Plants of Satawal Island, Caroline Islands. *A.R.B.* No. 132:1-13.
Vegetation and plant list from Satawal in the Caroline Islands with native plant names.

1970. Observations on the Green Turtle in the Marshall Islands. *In* Atoll News and Comment. *A.R.B.* No. 135:9-12.
Observations of green turtles from Jemo and Bikar in the Northern Marshalls with notes on egg laying and hatching.

1972. List of Vascular Plants from the reef islands of Rarotonga. *A.R.B.* No. 160:9-14.
List of plants collected in 1969 by W.R. Philipson from the reef islands of Rarotonga. Bibliography, maps and photographs

1972. Morotiri (Bass Rocks) Austral Islands. *In* Island News and Comment. *A.R.B.* No. 162:9-10.
Brief description of flora and fauna found on Morotiri in the Austral Islands.

1975. Vascular Plants of Aitutaki. *In* Stoddart and Gibbs (editors) Almost-Atoll of Aitutaki: Reef Studies in the Cook Islands, South Pacific. *A.R.B.* No. 190:73-84.
List of vascular plants collected from the main island of Aitutaki and also from some of the reef islands. Map and bibliography.

Fosberg, F. Raymond (cont)

1983. Natural History of Cousin Island. *In* Sachet, Stoddart, and Fosberg (editors) Floristics and Ecology of Western Indian Ocean Islands. *A.R.B.* No. 273:7-38.

Geology and geography of Cousin Island, fauna, original and existing vegetation, and comments on conservation and maintenance of bird sanctuary. Systematic list of plants. Bibliography and maps.

1985. Classification of Emergent Reef Surfaces. *A.R.B.* No. 292:29-38.

Proposal of classification scheme for emergent reefs which facilitates analysis and comparison. Classification diagram and. short bibliography.

1985. Botanical Visits to Krakatau in 1958 and 1963.. *A.R.B.* No. 292:39-48.

Observations on three visits between 1951 and 1971 to Anak Krakatau showing recolonization by plants. Plant lists.

1987. Marie-Hélène Sachet: Islands, Atolls and Reefs. *In* Introduction to Marie-Hélène Sachet Commemorative Issue. *A.R.B.* No. 293:1-7.

Eulogy to Marie-Hélène Sachet. Biography and account of her research activities.

1987. Flora of the Gilbert Islands, Kiribati, Checklist. *A.R.B.* No. 295:1-33.

Preliminary checklist of vascular plants of the Gilbert Islands.

1988. The Vegetation of Bikini Atoll 1985. *A.R.B.* No. 315:1-28.

Comparison of vegetation before the nuclear tests with vegetation in 1985 noting the reestablishment of much native forest and scrub vegetation and the luxuriance of some species. Plant lists, maps, and bibliography.

1989. Henderson Island: Dedicated to S. Dillon Ripley. *A.R.B.* No. 321:1-2.

Background of the 1984 Smithsonian Henderson Island Expedition.

1990. A Review of the Natural History of the Marshall Islands. *A.R.B.* No. 330:1-100.

Summary of knowledge about natural phenomena in the Marshall Islands. Geography, geologic history, climate, soils, hydrology, vegetation, and descriptions of each atoll and island. Bibliography.

Fosberg, F. Raymond and A. A. Bullock

1971. List of Diego Garcia Vascular Plants. *In* Stoddart and Taylor (editors) Geography and Ecology of Diego Garcia Atoll, Chagos Archipelago. *A.R.B.* No. 149:143-160.

Account of the vascular plants from Diego Garcia examined by the Authors with records from the Willis and Gardiner (1931) list.

Fosberg, F. Raymond and Dorothy Carroll

1965. Unconsolidated Sediments Considered as Soils. *In* Fosberg and Carroll (editors) Terrestrial Sediments and Soils of the Northern Marshall Islands. *A.R.B.* No. 113:43-67.

General character of atoll soils, soil forming factors, biological factors, composition, soil categories, chemical analyses of profiles. Maps, graphs, photographs.

Fosberg, F. Raymond and Dorothy Carroll (editors)

1965. Terrestrial Sediments and Soils of the Northern Marshall Islands. *A.R.B.* No. 113:1-156.

Investigation of geology, islet formation, sedimentation, and the physical and chemical nature of sediments in the Northern Marshalls. Bibliography, sample information, soil profiles descriptions, synonymy of Marshall Islands place names.

Fosberg, F. Raymond and Michael Evans

1969. A Collection of Plants from Fais, Caroline Islands. *A.R.B.* No. 133:1-15.

Vegetation and plant list from Fais in the Caroline Islands with native plant names.

Fosberg, F. Raymond, E. W. Groves and D. C. Sigee

1966. List of Addu Vascular Plants. *In* Stoddart (editor) Reef Studies at Addu Atoll, Maldive Islands: Preliminary Results of an Expedition to Addu Atoll in 1964. *A.R.B.* No. 116:75-92.
List of vascular plants from Addu -- mainly Gan and Hitaddu Islets.

Fosberg, F. Raymond, Gustav Paulay, T. Spencer, and Royce Oliver

1989. New Collections and Notes on the Plants of Henderson, Pitcairn, Oeno and Ducie Islands. *A.R.B.* No. 329:1-18.
Annotated list of plants found in the Pitcairn Group. Updates earlier list (Fosberg, Sachet and Stoddart 1983) by including plants not previously noted, by making adjustments in nomenclature, and by commenting on variability. Bibliography.

Fosberg, F. Raymond and S. A. Renvoize

1970. Plants of Farquhar Atoll. *In* Stoddart (editor) Coral Islands of the Western Indian Ocean. *A.R.B.* No. 136:27-34.
Plant list of Farquhar Atoll with collections references.

1970. Plants of Cosmoledo Atoll. *In* Stoddart (editor) Coral Islands of the Western Indian Ocean. *A.R.B.* No. 136:57-66.
List of plants of Cosmoledo Atoll with reference to prior collections.

1970. Plants of Astove. *In* Stoddart (editor) Coral Islands of the Western Indian Ocean. *A.R.B.* No. 136:101-112.
List of plants from Astove with reference to prior collections.

1970. Plants of Assumption Island. *In* Stoddart (editor) Coral Islands of the Western Indian Ocean. *A.R.B.* No. 136:147-154.
List of plants of Assumption with reference to prior collections.

1970. Plants of Desroches. *In* Stoddart (editor) Coral Islands of the Western Indian Ocean. *A.R.B.* No. 136:167-170.
List of plants from Desroches with reference to prior collections.

1970. Plants of Remire (Eagle) Island Amirantes. *In* Stoddart (editor) Coral Islands of the Western Indian Ocean. *A.R.B.* No. 136:183-186.
List of plants of Remire with reference to prior collections.

1970. Plants of African Banks (Iles Africaines). *In* Stoddart (editor) Coral Islands of the Western Indian Ocean. *A.R.B.* No. 136:193-194.
List of plants from African Banks with reference to prior collections.

Fosberg, F. Raymond and Marie-Hélène Sachet

1962. Vascular Plants Recorded From Jaluit Atoll. *A.R.B.* No. 92:1-39.
History of botanical work on Jaluit. List of plant collections in herbaria. Bibliography.

1969. Wake Island Vegetation and Flora, 1961-1963. *A.R.B.* No. 123:1-15.
Vegetation and Flora of Wake Island with observations concerning the vegetational recovery 10 years following the typhoon of 1952.

1987. Flora of Maupiti, Society Islands. *A.R.B.* No. 294:1-70.
Description of vegetation of Maupiti showing that there is practically nothing left of its original natural vegetation. Plant list.

Fosberg, F. Raymond and Marie-Hélène Sachet (editors)

1953. Handbook for Atoll Research (Second Preliminary Edition). *A.R.B.* No. 17:1-129.

Collection of 32 papers offering guidelines for research on Atolls covering geography, meteorology, geology, hydrology, soil science, botany, zoology, marine ecology, anthropology, and field work conditions.

Fosberg, F. Raymond, Marie-Hélène Sachet and David R. Stoddart

1983. Henderson Island (Southeastern Polynesia): Summary of Current Knowledge. *A.R.B.* No. 272:1-47.

History, vegetation, flora, birds, mammals, reptiles, terrestrial arthropods of Henderson Island. Reference to endangered Henderson Rail (*Porzana atra*) and Henderson lorikeet (*Vini stepheni*). Bibliography, photographs.

1983. List of the Recorded Vascular Flora of Agalega. *In* Sachet, Stoddart, and Fosberg (editors) Floristics and Ecology of Western Indian Ocean Islands. *A.R.B.* No. 273:109-142.

Preliminary list of vascular plants noted in literature for Agalega. Bibliography.

Fosberg, F. Raymond, David R. Stoddart, Marie-Hélène Sachet and David L. Spellman

1982. Plants of the Belize Cays. *A.R.B.* No. 258:1-77.

Annotated list of vascular plants known from sand and mangrove cays off Belize with classification of cays. Bibliography and indices by plant name and islands cited.

Fosberg, F. Raymond and R. F. Thorne

1961. Vascular Plants of Heron Island. *A.R.B.* No. 82:5-14.

List of plants collected by Fosberg and Thorne with reference to previous collections by MacGillivray and Rodway from Heron Island, Great Barrier Reef.

Fosberg, F. Raymond [with J.W. Wells, M.S. Doty, and Ruth Todd]

1965. Other Features. *In* Fosberg and Carroll (editors) Terrestrial Sediments and Soils of the Northern Marshall Islands. *A.R.B.* No. 113:23-30.

Description of soils, drainage, vegetation and principal reef-forming animals and plants (Coral by J.W. Wells, Foraminifera by Ruth Todd, Algae by M.S. Doty) Charts and photographs.

Francis, M. P.

1981. Distribution and Abundance of the Crown-of-Thorns Starfish (*Acanthaster planci*) around Tongatapu Island, Tonga. *A.R.B.* No. 255:63-68.

Survey of *Acanthaster planci* around Tongatapu Island. Bibliography.

Frankel, E.

1978. Evidence from the Great Barrier Reef of Ancient *Acanthaster* Aggregations. *In* Smith (editor) Coral Reef Ecosystems: Proceedings of Papers Presented at the 13th Pacific Science Congress, Vancouver. *A.R.B.* No. 220:75-94.

Report on search for early aggregations of *Acanthaster planci* on the Great Barrier Reef. Photographs, tables, and bibliography.

Frith, C. B.

1975. Predation upon Hatchlings and Eggs of the Green Turtle, *Chelonia mydas*, on Aldabra Atoll, Indian Ocean. *In* Island News and Comment. *A.R.B.* No. 185:11-12.

Pattern of predation on turtle eggs and hatchlings observed on Aldabra. Bibliography.

1977. Life History Notes on Some Aldabran Land Birds. *A.R.B.* No. 201:1-15.

Observations on land birds of Aldabra – not including endemic weaverbird – and their ecology, habitats, and breeding behavior. Bibliography.

Frith, D. W.

1979. A List of Insects Caught in Light Traps on West Island, Aldabra Atoll, Indian Ocean. *A.R.B.* No. 225:1-12.

List of insects collected from West Island, Aldabra during 1971-1972. Chronology of earlier entomological collections. Bibliography.

Galzin, René

1985. Non-selective Fishing Methods of Futuna (Horn Archipelago, West Polynesia). *A.R.B.* No. 292:1-10.

Description of two fishing methods used by women of Futuna. Suggestion that fishing techniques may endanger fish fauna. Bibliography, map, tables.

1987. Potential Fisheries Yield of a Moorea Fringing Reef (French Polynesia) by the Analysis of Three Dominant Fishes. *A.R.B.* No. 305:1-17.

Presentation of data on the biology, biomass and growth of three species of reef fish: *Ctenochaetus striatus*, *Stegastes nigricans*, and *Sargocentron*. Estimate of the productivity of reef fishery on Moorea. Bibliography, tables, map.

Gaymer, R.

1967. Observations on the Birds of Aldabra in 1964 and 1965. *A.R.B.* No. 118:112-125.

Observations of land birds and brief notes on sea and shore birds from Bristol Seychelles Expedition of 1964-1965. Bibliography.

Gerber, Ray P.

1981. Species Composition and Abundance of Lagoon Zooplankton at Eniwetak Atoll, Marshall Islands. *A.R.B.* No. 247:1-22.

Study of species composition and abundance of lagoon zooplankton of Enewetak Atoll comparing winter and summer diversity. Map, bibliography, and chart.

Gerhard, Lee C.

1977. Submarine Cementation of Grainstone Fabric, St. Croix, U.S. Virgin Islands. *A.R.B.* No. 196:1-5.

Occurrence and explanations for submarine cemented carbonate sand nodules off St. Croix in the U.S. Virgin Islands. Bibliography, photographs, charts.

1981. Origin and Evolution of the Candlelight Reef Sand Cay System, St. Croix. *A.R.B.* No. 242:1-11.

Study of origins and evolution of Candlelight Reef and Cay system off St. Croix using two coring methods. Results of analysis of core contents. Bibliography, photographs, and maps.

Gerlach, Sebastian A.

1961. The Tropical Coral Reef as a Biotope. *A.R.B.* No. 80:1-6.

Study of microfauna in coral reef ecosystems of the Red Sea and the Maldives. Categorization of macrofauna of coral reefs according to feeding strategy. Bibliography.

Gibbs, P. E.

1975. A Survey of the Macrofauna Inhabiting the Lagoon Deposits on Aitutaki, Cook Islands. *In* Stoddart and Gibbs (editors) Almost-Atoll of Aitutaki: Reef Studies in the Cook Islands, South Pacific. *A.R.B.* No. 190:123-132.

Macrofauna inhabiting the littoral and sub-littoral deposits in the Aitutaki lagoon. Bibliography, tables, and maps.

Gibbs, P. E., H. G. Vevers and David R. Stoddart

1975. The Marine Fauna of the Cook Islands: A Check-List of the Species Collected During the Cook Bicentenary Expedition in 1969. *In* Stoddart and Gibbs (editors) Almost-Atoll of Aitutaki: Reef Studies in the Cook Islands, South Pacific. *A.R.B.* No. 190:133-148.

Check list of marine fauna based on collections taken in 1969. Bibliography.

Gilbert, William J.

1983. Some Marine Benthic Algae from Christmas Island, Line Islands. *A.R.B.* No. 265:1-6.

List of algae from Christmas Island from Gilbert's own collections and from those of Maxwell Doty. Bibliography.

Gillett, Robert

1988. A Tokelau Fisheries Bibliography. *A.R.B.* No. 319:9-18.

Bibliography of literature pertaining to fisheries in the Tokelau Islands with references to the source libraries.

Gillham, Mary E.

1977. Observations on Vegetation of Blue-Faced Booby Colonies on Cosmoledo Atoll, Western Indian Ocean. *A.R.B.* No. 199:1-11.

Observations on the ecology and habitats of sea birds of Cosmoledo Atoll with comments on the vegetative degeneration- regeneration cycle associated with nesting birds. Comparison between Cosmoledo and Aldabra. Bibliography.

1977. Vegetation of Sea and Shore-bird Colonies on Aldabra Atoll. *A.R.B.* No. 200:1-19.

Observations on the ecology and habitats of sea birds of Aldabra Atoll with mention of exotics observed there. Bibliography.

Gillis, William T.

1977. Remarks on the Botany and Statistics of the Bahama Islands. *In* Island News and Comment. *A.R.B.* No. 219:12-16.

Discussion of vegetation and plant distribution patterns in the Bahamas: suggestion of phytogeographic hypotheses relating to Bahama flora. Tables.

Gillis, William T., Roger Byrne and Wyman Harrison

1975. Bibliography of the Natural History of the Bahama Islands. *A.R.B.* No. 191:1-123.

Bibliography of literature about the Bahamas divided by subject area. Includes anthropology and folklore, public health and fiction as well as strict natural history.

Goldberg, Walter M.

1983. Cay Sal Bank, Bahamas: A Biologically Impoverished, Physically Controlled Environment. *A.R.B.* No. 271:1-17.

Physical and biological structure of the bank lagoon of Cay Sal Bank. Description of major zones. Plant and invertebrate list, bibliography, photographs, charts, maps.

Goudie, Andrew

1969. A Note on Mediterranean Beachrock: Its History. *In* Atoll News and Comment. *A.R.B.* No. 126:11-14.

Speculation concerning the age of beachrock at Viransehir in Southern Turkey.

Gould, Margaret S., M. Garry Hill and David McC. Newbery

1983. The Goat and the Coccid: Interactions Between two Introduced Herbivores and the Vegetation of Aldabra Atoll. *In* Sachet, Stoddart, and Fosberg (editors) Floristics and Ecology of Western Indian Ocean Islands. *A.R.B.* No. 273:247-253.

Study of combined effects of two species introduced onto Aldabra (Western Indian Ocean) who feed on overlapping sets of plants. Goat feeding preferences and *Icerya* feeding preferences. Bibliography.

Green, Owen

1989. Foraminiferal Composition of Henderson Island Beach Sand. *A.R.B.* No. 324:7-8.

List of Superfamilies and Families of Foraminifera represented in beach sands of Henderson Island.

Grelet, Y., C. Falconetti, B. A. Thomassin, P. Vitiello and A. H. Abu Hilal

1987. Distribution of the Macro- and Meiobenthic Assemblages in the Littoral Soft-Bottoms of the Gulf of Aqaba (Jordan). *A.R.B.* No. 308:1-14.

Summary of spatial distribution of macro- and meiobenthic assemblages in sandy bottoms of Gulf of Aqaba. Tables, figures and bibliography.

Gressitt, J. Linsley

1952. Description of Kayangel Atoll, Palau Islands. *A.R.B.* No. 14:1-7.

Brief description of Kayangel Atoll in the Palau group. Vegetation, fauna, fresh water. Maps.

1953. Notes on Ngeruangl and Kayangel Atolls, Palau Islands. *A.R.B.* No. 21:1-5.

Short description of two atolls in the Palau group with list of plants collected by Gressitt from Kayangel.

1961. Terrestrial Fauna. *In* Blumenstock (editor) A Report on Typhoon Effects Upon Jaluit Atoll. *A.R.B.* No. 75:69-74.

Impact of typhoon Ophelia on terrestrial animals with observation that losses were low.

Grosenbaugh, Deborah A.

1981. Qualitative Assessment of Asteroids, Echinoids and Holothurians in Yap Lagoon. *A.R.B.* No. 255:49-54.

Survey of echinoderms in Yap Lagoon resulting from concern about *Acanthaster planci*. Bibliography.

Gross, A. O., J. M. Moulton and C. E. Huntington

1963. Notes on the Wedge-Tailed Shearwater at Heron Island, Great Barrier Reef, Australia. *A.R.B.* No. 99:1-11.

Study of the behavior and nesting activities of wedge-tailed shearwater (*Puffinus pacificus chlororhynchus*) including description of songs. Bibliography and photographs.

Groves, E. W.

1966. A Brief History of Botanical Observations and Collections Made in the Maldive Islands, Indian Ocean. *In* Stoddart (editor) Reef Studies at Addu Atoll, Maldive Islands: Preliminary Results of an Expedition to Addu Atoll in 1964. *A.R.B.* No. 116:57-60.

History of botanical observations in the Maldives.

Grovhoug, J. G. and R. S. Henderson

1978. Distribution of Inshore Fishes at Canton Atoll. *In* Smith and Henderson (editors) Phoenix Islands Report I: An Environmental Survey of Canton Atoll Lagoon, 1973. *A.R.B.* No. 221:99-158.

Survey of abundance and diversity of fish in various localities around Canton Atoll. Explanation for the high diversity and number of fish close to the pass into the lagoon. Transects, maps, bibliography.

Guinther, E. B.

1978. Observations on Terrestrial Surface and Subsurface Water as Related to Island Morphology at Canton Atoll. *In* Smith and Henderson (editors) Phoenix Islands Report I: An Environmental Survey of Canton Atoll Lagoon, 1973. *A.R.B.* No. 221:171-184.

Study of water samples on Canton Island revealing patterns of salinity in relation to island physiography and variations in nutrients. Map, bibliography.

Gwynne, M. D. and D. Wood

1969. Plants Collected on Islands in the Western Indian Ocean During a Cruise of the M.F.R.V. "Manihine," Sept-Oct 1967. *A.R.B.* No. 134:1-15.

Plant lists and collection numbers from Remire, Daros, Desroches, Coetivy, Farquhar, Cosmoledo, Astove, and Assumption in the Southwestern Indian Ocean. Bibliography.

Hackett, H. E.

1977. Marine Algae Known From the Maldive Islands. *A.R.B.* No. 210:1-29.

Description of the reefs of the Maldives and algal habitats. Systematic list of algae collected. Bibliography and diagram.

Hambler, C., K. Hambler and J. M. Newing

1985. Some Observations on *Nesillas aldabranus*, the Endangered Brush Warbler of Aldabra Atoll, with Hypotheses on its Distribution. *A.R.B.* No. 290:1-19.

Observations of the endangered Aldabran brush warbler, *Nesillas aldabranus* and its habitat, especially association with Dracaena reflexa. Hypotheses to guide future research and recommendations concerning conservation. Maps, bibliography, tables.

Harry, Robert R.

1953. Ichthyological Field Data of Raroia Atoll, Tuamotu Archipelago. *A.R.B.* No. 18:1-190.

Ichthyological study of Raroia. Description of ecological zones, checklist of fishes previously recorded from Tuamotus, systematic account of fish observed, gazeteer of Tuamotus, ethnoichthyology, bibliography, maps, diagrams.

Hass, Hans

1962. Central Subsidence. A New Theory of Atoll Formation. *A.R.B.* No. 91:1-4.

Results of research on atoll formation in the Maldives and Nicobars. Summary of theoretical issues and presentation of theory of central subsidence due to instability of inner structure of branching corals. Photographs, maps, diagrams.

Hatheway, William H.

1953. The Land Vegetation of Arno Atoll, Marshall Islands. *A.R.B.* No. 16:1-68.

Description of vegetation of Arno with emphasis on economic plants, vegetation change, and history. Bibliography and many maps.

1955. The Natural Vegetation of Canton Island, An Equatorial Pacific Atoll. *A.R.B.* No. 43:1-9.

Description of physical environment, and vegetation zones of Canton. Bibliography and map of plant habitats.

1957. Agricultural Notes on the Southern Marshall Islands, 1952. *A.R.B.* No. 55:1-9.

Discussion of several blights infecting coconut and breadfruit plantations, and general remarks on agriculture of the Southern Marshalls.

Heatwole, Harold

1975. Biogeography of Reptiles on some of the Islands and Cays of Eastern Papua -- New Guinea. *A.R.B.* No. 180:1-32.

General description of islands east of Papua New Guinea. Lists of terrestrial and aquatic reptiles. Ecology of herpetofauna with suggestions of relationships among island area, island form and species numbers. Bibliography, maps, charts and photographs.

Heatwole, Harold, Richard Levins and Michael D. Byer

1981. Biogeography of the Puerto Rican Bank. *A.R.B.* No. 251:1-55.

Survey of 141 of the islands in the Puerto Rican Bank. Description of climate, vegetation, geology, and island forms. Comments on environmental degradation. Bibliography, maps, dbn of spider and scorpion species, flora and herpetofauna lists.

Henderson, R. S., P. L. Jokiel, S. V. Smith and J. G. Grovhoug

1978. Canton Atoll Lagoon Physiography and General Oceanographic Observations. *In* Smith and Henderson (editors) Phoenix Islands Report I: An Environmental Survey of Canton Atoll Lagoon, 1973. *A.R.B.* No. 221:5-14.

Study of four major physiographic zones of Canton Atoll's lagoon. Discussion of wind drift and tidal flow. Bibliography, map, aerial photograph.

Herbst, Derral

1977. Vegetation. *In* Clapp and Kridler (authors) The Natural History of Necker Island, Northwestern Hawaiian Islands. *A.R.B.* No. 206:25-31.

Vegetation and list of plants found on Necker.

1977. Vegetation. *In* Clapp and Kridler (authors) The Natural History of Nihoa Island, Northwestern Hawaiian Islands. *A.R.B.* No. 207:26-38.

Vegetation and list of plants found on Nihoa.

Hiatt, Robert W.

1951. Marine Ecology. *A.R.B.* No. 2:5-6.

Marine ecology studies directed toward improving native welfare, encouraging conservation, increasing commercial exploitation of marine resources, and understanding biological problems.

1951. Marine Zoology Study of Arno Atoll, Marshall Islands. *A.R.B.* No. 4:1-13.

Summary of marine resource utilization on Arno.

1953. Methods of Collecting Marine Invertebrates on Coral Atolls. *A.R.B.* No. 17:78-89.

How to collect, document, preserve, and transport marine invertebrates.

1953. Instructions for Marine Ecological Work on Coral Atolls. *A.R.B.* No. 17:100-108.

Instructions for studying marine ecology with minimal resources. Check-list of essential equipment. How to choose, survey and describe (physically and biologically) a reef. Bibliography for faunal identification.

Hinckley, Alden D.

1969. The Ecology of Terrestrial Arthropods on the Tokelau Atolls. *A.R.B.* No. 124:1-18.

Analysis of arthropod communities in the Tokelaus with comments on establishment, extinction and displacement of certain insects like rhinoceros beetles, lygaeid bugs and sphinx moths. List of arthropods from Atafu, Nukunono, and Fakaofo. Bibliography.

Hnatiuk, R. J. and L. F. H. Merton

1979. Vegetation of Aldabra, a Reassessment. *A.R.B.* No. 239:1-21.

History of vegetation studies of Aldabra with comparison of alternative classificatory systems of vegetation zones. Presentation of comprehensive classification and synthesis of Aldabra vegetation. Bibliography.

Hogue, Charles L. and Scott E. Miller

1981. Entomofauna of Cocos Island, Costa Rica. *A.R.B.* No. 250:1-29.

General description of Cocos Island, Costa Rica. History of scientific expeditions and systematic list of insects identified during 1978 trip. Bibliography.

Holthuis, L. B.

1953. Enumeration of the Decapod and Stomatopod Crustacea from Pacific Coral Islands. *A.R.B.* No. 24:1-66.

Systematic list of decapod and stomatopod crustacea from the Pacific with collection and habitat information. Appendix contains collection data for specimens taken by R.W. Hiatt from Arno. Maps of Arno.

Hong, Goh Ah and A. Sasekumar

1981. The Community Structure of the Fringing Coral Reef, Cape Rachado, Malaya. *A.R.B.* No. 244:1-11.

Observations of coral and microalgae species diversity and abundance on the coral reef at Cape Rachado, Malaya with explanations of differences. Bibliography, graphs and diagrams.

Hounsome, M. V.

1980. Terrestrial Fauna (Excluding Birds and insects) of Little Cayman. *In* Stoddart and Giglioli (editors) Geography and Ecology of Little Cayman. *A.R.B.* No. 241:81-90.

List of terrestrial fauna (excluding birds and insects) from Little Cayman with reference to various habitat types and to habitats deserving special conservation consideration. Bibliography.

Hounsome, M. V. and R. R. Askew

1980. *Cerion nanus* (Maynard) (Mollusca: Cerionidae) on Little Cayman. *In* Stoddart and Giglioli (editors) Geography and Ecology of Little Cayman. *A.R.B.* No. 241:91-96.

Zoogeographic value of studies of Cerion. Distribution of *Cerion nanus*. Relationship between *C. pannosum* and *C. nanus*. Bibliography and photographs.

Hutson, A. M.

1975. Observations on the Birds of Diego Garcia, Chagos Archipelago with notes on other vertebrates. *A.R.B.* No. 175:1-25.

Systematic list of birds of Diego Garcia (Western Indian Ocean), with brief mention of reptiles and mammals. Map and bibliography.

1981. A Preliminary List of Insects of Diego Garcia Atoll, Chagos Archipelago. *A.R.B.* No. 243:1-29.

List of insects collected on Diego Garcia (Western Indian Ocean) in 1971 with reference to earlier collections and records. Bibliography.

Ineich, Ivan and Charles P. Blanc

1988. Distribution des Reptiles Terrestres en Polynésie Orientale. *A.R.B.* No. 318:1-75.

An account of terrestrial reptiles occurring in Eastern Polynesia including a description of their biogeographic characteristics, species distributions, and the present state of knowledge. In French. Species lists, tables, bibliography, and gazetteer.

Ing, Bruce and R. J. Hnatiuk

1981. Myxomycetes of Aldabra Atoll. *A.R.B.* No. 249:1-10.

List of myxomycetes from Aldabra with ecological notes. Map and bibliography.

Irwin, J.

1985. The Underwater Morphology of Palmerston and Suwarrow Atolls. *A.R.B.* No. 292:109-113.

Results of echo sounding surveys conducted in Palmerston and Suwarrow lagoons. Maps, graphs, bibliography.

Johnson, Clifford Ray

1972. Notes on the Herpetofauna of Kume-Jima and O-Jima, Ryukyu Islands Island News and Comment. *A.R.B.* No. 162:7-9.

List of herpetofauna from the Ryukyus. Bibliography.

Johnson, J. Harlan

1953. Suggestions for Collecting Modern and Fossil Calcareous Algae. *A.R.B.* No. 17:63-64.

How to collect modern and fossil algae and related field data.

Jokiel, P. L. and J. E. Maragos

1978. Reef Corals of Canton Atoll: II. Local Distribution. *In* Smith and Henderson (editors) Phoenix Islands Report I: An Environmental Survey of Canton Atoll Lagoon 1973. *A.R.B.* No. 221:71-98.

Study of distribution and abundance of species of reef corals at Canton with reference to ecological conditions. Maps, charts, bibliography.

Jordan, Eric and Eduardo Martin

1987. Chinchorro: Morphology and Composition of a Caribbean Atoll. *A.R.B.* No. 310:1-20.

Description of morphology of Chinchorro and its leeward and windward reefs with an account of Scleractinian and Gorgonian corals, algae and sponges. Photographs, charts, maps and bibliography.

Kay, E. Alison

1978. Molluscan Distribution Patterns at Canton Atoll. *In* Smith and Henderson (editors) Phoenix Islands Report I: An Environmental Survey of Canton Atoll Lagoon, 1973. *A.R.B.* No. 221:159-170.

Description of assemblages of micromollusks and gastropods from three parts of Canton Atoll lagoon. Suggestion that water chemistry accounts for differences in distribution.

Keplin, P. A. and P. A. Pirazzoli

1988. A Geomorphological Reconnaissance of Coetivy Atoll (Seychelles, Indian Ocean). *A.R.B.* No. 319:1-8.

A preliminary geomorphological description of Coetivy Atoll with a discussion of its history and the continuity of sea levels. Photographs, maps, figures, and bibliography

Kinzie, R. A.

1978. An Evaluation of Coral Reef Survey Methods by Computer Simulation. *In* Smith (editor) Coral Reef Ecosystems: Proceedings of Papers Presented at the 13th Pacific Science Congress, Vancouver. *A.R.B.* No. 220:21-24.

Use of computer program to simulate coral distribution on a reef and test of several sampling strategies to determine the relative costs in time and effort vs the relative benefits in accuracy. Bibliography.

Kochi, John

1971. Objectives and Importance of Conservation. *In* Island News and Comment. *A.R.B.* No. 148:21-22.

Guidelines to promote conservation in Palau.

Kohn, Alan J

1964. Notes on Indian Ocean Atolls Visited by the Yale Seychelles Expedition. *A.R.B.* No. 101:1-12.

Observations and notes on collections made from reefs of islands in the Maldives. Bibliography, charts, photographs.

1964. Notes on Reef Habitats and Gastropod Molluscs of a Lagoon Island at North Malé Atoll, Maldives. *A.R.B.* No. 102:1-5.

Theories on the formation of lagoon islands, such as Funidu, of Malé Atoll, Maldives. Description of Funidu. Notes on gastropod mollusks found there. Map and bibliography.

1971. Inshore Marine Habitats of Some Continental Islands in the Eastern Indian Ocean. *A.R.B.* No. 140:1-29.

Description of features of habitats at 15 stations on islands off Thailand and Sumatra. Special attention to geomorphology, zonation, and reef plants and invertebrates. Maps, charts, photographs, and bibliography.

Kondo, Yoshio

1961. Gastropod Molluscs Collected by J.L. Gressitt. *In* Blumenstock (editor) A Report on Typhoon Effects Upon Jaluit Atoll. *A.R.B.* No. 75:105.

List of land and marine species of gastropod mollusks collected by Gressitt.

Kurashina, Hiro, D. Ballendorf, K. Carriveau, M. Driver, B. Karolle, T. McGrath and A. Williams

1987. Recent Activities of the Micronesian Research Center (MARC). *In* Introduction to Marie-Hélène Sachet Commemorative Issue. *A.R.B.* No. 293:11-14.

Brief description of the range of research, collections management and educational activities undertaken at M.A.R.C.

Lamberts, Austin E.

1983. An Annotated Check List of the Corals of American Samoa. *A.R.B.* No. 264:1-19.

List of scleractinian and non-scleractinian corals collected from American Samoa and now in the Smithsonian and the Hessisches Landesmuseum, W. Germany. Lists include frequency of occurrence and habitat. Bibliography.

Lamoureux, Charles H.

1961. Botanical Observations on Leeward Hawaiian Atolls. *A.R.B.* No. 79:1-10.

Systematic plant list from Green Island and Tern Island, French Frigate Shoal and Kure Atoll following construction of two Loran Coast Guard stations and exotic plant introductions. Aerial photo of Green Island.

1963. The Flora and Vegetation of Laysan Island. *A.R.B.* No. 97:1-14.

Vegetation and list of plants noted from Laysan emphasizing changes over time. Bibliography and photographs.

Lathrop, C. J.

1953. Hints on Tropical Photography. *A.R.B.* No. 17:123-124.

How to beat the impediments to taking good black and white pictures in tropical humid conditions.

Lavoie, Ronald L.

1963. Some Aspects of the Meteorology of the Tropical Pacific viewed from an Atoll. *A.R.B.* No. 96:1-80.

Detailed climatological study of Enewetak. Maps, charts, graphs, bibliography.

Leopold, Luna B.

1951. Pacific Meteorological Problems. *A.R.B.* No. 1:11.

Suggestions for meteorological data that need to be collected.

1953. Notes on the Collection of Meteorological Information on Tropical Islands. *A.R.B.* No. 17:10-13.

How to collect data on rainfall, wind velocity and direction, and water temperature on coral atolls.

Lewis, John B.

1975. A Preliminary Description of the Coral Reefs of the Tobago Cays, Grenadines, West Indies. *A.R.B.* No. 178:1-9.

Description of coral reefs of the Tobago Cays and their biotic communities. Bibliography, maps and diagrams.

Lionnet, J. F. G.

1970. Note on the Lepidoptera of Astove Atoll. *In* Stoddart (editor) Coral Islands of the Western Indian Ocean. *A.R.B.* No. 136:113-114.

List of butterflies from Astove with reference to prior collections. Bibliography.

Lionnet, J. F. G. (cont)

1970. Names of the Islands. *In* Stoddart (editor) Coral Islands of the Western Indian Ocean. *A.R.B.* No. 136:221-224.

Origins of island names in Western Indian Ocean. Bibliography.

Littler, M. M., P. R. Taylor, D. S. Littler, R. H. Sims and J. N. Norris

1985. The Distribution, Abundance and Primary Productivity of Submerged Macrophytes in a Belize Barrier-Reef Mangrove System. *A.R.B.* No. 289:1-16.

Comparison of macrophyte assemblages in turbulent and sheltered mangrove systems. Bibliography and tables

1987. Dominant Macrophyte Standing Stocks, Productivity and Community Structure on a Belizean Barrier Reef. *A.R.B.* No. 302:1-18.

Description of the macrophyte zonational patterns and primary productivity of dominant plant life for the seaward margin of Carrie Bow Cay. Bibliography, maps, photographs, figures, and tables

Macintyre, Ian G.

1975. A Diver-operated Hydraulic Drill for Coring Submerged Substrates. *In* Island News and Comment. *A.R.B.* No. 185:21-24.

Design and specifications for a new portable, submersible drill useful for sampling underwater substrates. Bibliography and photographs.

Macintyre, Ian G. and Walter H. Adey

1990. Buck Island Bar, St. Croix, USVI: A Reef that Cannot Catch up with Sea Level. *A.R.B.* No. 336:1-7.

Discussion of coral growth rates on Buck Island Bar near St. Croix as a function of frequency of storms. Maps, photograph, bibliography.

Macintyre, Ian G., Bill Raymond and Robert Stuckenrath

1983. Recent History of a Fringing Reef, Bahia Salina del Sur, Vieques Island, Puerto Rico. *A.R.B.* No. 268:1-6.

Study of cores from a reef on Bahia Salina del Sur which show that framework communities of many sea-level reefs are migrating leeward. Radiocarbon dates, charts, aerial photos, diagrams, photographs.

Mackenzie, J. B.

1961. Marine Resources. *In* Blumenstock (editor) A Report on Typhoon Effects Upon Jaluit Atoll. *A.R.B.* No. 75:79-80.

Effect of typhoon Ophelia on fisheries and potential for toxicity of lagoon species.

MacMillan, H. G.

1951. Economic Development of Coral Atolls. *A.R.B.* No. 2:2.

Progress and future plans of the South Pacific Commission on Tarawa. Work of René and Mme Catala.

Maina, Shirley L., Leslie Pray and Robert A. DeFilipps

1988. A Historical Note on the Endangered *Santalum boninensis* (Santalaceae) of the Ogasawara Islands: Early Reports by Takasi Tuyama. *A.R.B.* No. 319:19-24.

Edited translation of Takasi Tuyama's report on *Santalum boninensis* and the needs for its conservation. Bibliography

Maragos, J. E. and P. L. Jokiel

1978. Reef Corals of Canton Atoll: I. Zoogeography. *In* Smith and Henderson (editors) Phoenix Islands Report I: An Environmental Survey of Canton Atoll 1973.. *A.R.B.* No. 221:55-70.

Description of coral found on Canton Atoll. Distribution and abundance of coral species and comparison with similar distributions from the Indian Ocean. Bibliography.

Marsh, James A. and Roy T. Tsuda

1973. Population Levels of *Acanthaster planci* in the Mariana and Caroline Islands, 1969-1972. *A.R.B.* No. 170:1-16

Survey of *Acanthaster planci* in Mariana Islands, Palau, Yap, Central Caroline Islands, Pohnpei, and outer islands. Results of *A. planci* symposium 1970. Bibliography and charts.

Marshall, J. T.

1951. Vertebrate Ecology of Arno Atoll, Marshall Islands. *A.R.B.* No. 3:1-38.

Summary of terrestrial vertebrate fauna on Arno. Remarks about human parasites and termites. Thoughts on carrying capacity concept. Distribution maps.

1953. Suggestions as to Collecting Land Vertebrates on Coral Atolls. *A.R.B.* No. 17:65-68.

How to document, catalog, label, and preserve land vertebrates with advice on valuable related observations and collections.

1957. Atolls Visited During the First Year of the Pacific Islands Rat Ecology Project. *A.R.B.* No. 56:1-11.

Survey of rats on atolls close to Pohnpei with remarks about other aspects of the fauna and flora. Tables.

Marshall, Keith

1969. A New Method for Sewage Treatment on Coral Atolls. *In* Atoll News and Comment. *A.R.B.* No. 126:10-11.

A method for sewage disposal and treatment on coral atolls requiring minimal equipment, adaptable to animal wastes, and providing fertilizer and methane gas.

Marshall, Mac

1975. The Natural History of Namoluk Atoll, Eastern Caroline Islands. *A.R.B.* No. 189:1-54.

Physical description of Namoluk with description of flora and fauna of island. Special mention of *Acanthaster planci*. Native plant and bird names. Bird, mollusk and plant lists. Photographs and bibliography.

Mason, Leonard

1951. Man in the Culture-Environment Relationship. *A.R.B.* No. 2:12-13.

Practical and theoretical utility of research on human adaptations to coral atolls, and proposed future research.

1952. Anthropology-Geology Study of Arno Atoll, Marshall Islands. *A.R.B.* No. 10:1-21.

Description of the natural resources and demographic situation of Arno with comments on acculturation, war effects, commerce, political authority, and land. Map and proposed orthography (by Elbert) appended.

1953. Suggestions for Investigating the Cultures of Atoll Peoples. *A.R.B.* No. 17:111-115.

Basic cultural and demographic features to describe in atoll communities with a sample census card from Arno.

Mason, Leonard and Harry Uyehara

1953. A Quantitative Study of Certain Aspects of the Man-Land Relationship in Marshallese Economy. at Arno Island. *A.R.B.* No. 17:116-121.

Description of Uyehara's economic anthropology research on Arno with recommendations that additional research pertaining to demographics and the economics of production and consumption be done. Sample survey questionnaire from Arno.

Mason, R. R.

1960. Some Aspects of Agriculture on Tarawa Atoll, Gilbert Islands. *A.R.B.* No. 73:1-17.

Description of soils, hydrology, animal husbandry, agriculture and agricultural technology on Tarawa. Suggestions for development of native agriculture. Map.

Mathis, Wayne N.

1989. Diptera (Insecta) or True Flies of the Pitcairn Group (Ducie, Henderson, Oeno, and Pitcairn Islands). *A.R.B.* No. 327:1-15.

Annotated checklist of Diptera of Pitcairn Group with speculation about origins of this fauna. Bibliography.

McKee, Edwin D.

1956. Geology of Kapingamarangi Atoll, Caroline Islands. *A.R.B.* No. 50:1-38.

Description of the geology, petrology, soils, phosphorite deposits, and ground water of Kapingamarangi. Maps, charts, tables, and bibliography.

1961. Island Structures and Their Modification. *In* Blumenstock (editor) A Report on Typhoon Effects Upon Jaluit Atoll. *A.R.B.* No. 75:37-40.

Description of Typhoon Ophelia's effect on island structures. Charts and diagrams.

1961. Removal of Fine Sediments from Islets. *In* Blumenstock (editor) A Report on Typhoon Effects Upon Jaluit Atoll. *A.R.B.* No. 75:41-42.

Typhoon Ophelia's destruction of sediments.

1961. Ground Water. *In* Blumenstock (editor) A Report on Typhoon Effects Upon Jaluit Atoll. *A.R.B.* No. 75:43-46.

Typhoon Ophelia's effect on ground water quality with analyses of water from various wells.

Mergner, Hans

1985. Initial Recolonization of Funafuti Atoll Coral Reefs Devastated by Hurricane "Bebe". *A.R.B.* No. 284:1-19.

Recolonization and succession of corals in reefs destroyed 8 months earlier by a hurricane. Comments on the decisive role of branched coral in reef succession. Maps, tables, diagrams, photographs, bibliography.

Meylan, Anne Barkau

1983. Marine Turtles of the Leeward Islands, Lesser Antilles. *A.R.B.* No. 278:1-24.

Island by island survey of marine turtles of the Leeward Islands in the Caribbean including Anguilla, St. Martin, Saba, St. Eustatius, St. Kitts, Nevis, Barbuda, Antigua, Montserrat, and Guadeloupe. Map, photographs, and bibliography.

Milhurn, John D.

1959. Health and Sanitation Survey of Arno Atoll. *A.R.B.* No. 62:1-7.

Survey of health conditions on Arno with test results for certain diseases and parasites.

Miller, Harvey Alfred

1955. Bryophytes Collected by F. R. Fosberg in the Marshall Islands. *A.R.B.* No. 40:1-5.

Analysis of Collection by Fosberg of mosses and liverworts from N. Marshalls. Collections documentation, bibliography, map.

Miller, Harvey Alfred and Maxwell S. Doty

1953. Bryophytes from Arno Atoll, Marshall Islands. *A.R.B.* No. 25:1-11.

Key to bryophytes found on Arno for the sake of future non- bryologists. Illustrations and explanations. Bibliography.

1954. Ecological and Floristic Notes on the Bryophyta of Raroia. *A.R.B.* No. 33:55-56.

Notes on collections of moss and liverworts from Raroia.

Miller, Ralph E.

1953. Health Report on Kapingamarangi. *A.R.B.* No. 20:1-42.

Three parts: I. A health survey describing aspects of Kapingamarangi that influence health, disease incidence, demographic profile, epidemiological history, ethnomedicine. II: Parasitologic survey with data for individuals. III: Blood groups represented.

Milliman, John D.

1965. An Annotated Bibliography of Recent Papers on Coral and Coral Reefs. *A.R.B.* No. 111:1-58.

Annotated bibliography of literature on coral and coral reefs. Divided into 1) Geological features, 2) Ecology, 3) Coral, and 4) other bibliographies.

1969. Four Southwestern Caribbean Atolls: Courtown Cays, Albuquerque Cays, Roncador Bank, and Serrana Bank. *A.R.B.* No. 129:1-26.

General description of four atolls in southwestern Caribbean. Bibliograph, maps, and appendix.

Milliman, John D. and Conrad V. W. Mahnken

1969. Reef Productivity Measurements. *A.R.B.* No. 129:23-25.

Levels of Oxygen uptake on reef flats and levels of plankton productivity.

Minton, Sherman A. and William W. Dunson

1985. Sea Snakes Collected at Chesterfield Reefs, Coral Sea. *A.R.B.* No. 292:101-108.

Notation of six species of sea snakes on Chesterfield Reefs, and comments on general distribution of these snakes. Maps, species list, bibliography.

Montaggioni, L. F., C. Gabrie, O. Naim, C. Payri, G. Richard and B. Salvat

1987. The Seaward Margin of Makatea, an Uplifted Carbonate Island (Tuamotus, Central Pacific). *A.R.B.* No. 299:1-18.

Description of reef ecology with observation that algal, coral and macrofaunal communities are relatively sparse on Makatean reef flats. Bibliography, maps, figures.

Monteforte, Mario

1987. The Decapod Reptantia and Stomatopod Crustaceans of a Typical High Island Coral Reef Complex in French Polynesia (Tiahura, Moorea Island): Zonation, Community Composition and Trophic Structure. *A.R.B.* No. 309:1-37.

Sorting of crustacean species into five morphologic groups based on nutritional mode with comments on associated trophic and habitat partitioning and suggestions of interspecific relations. Illustrations, charts and bibliography.

Morgan, H. J.

1975. Checklist of The Morgan Collection of Mollusc Shells From the Cook Islands. *In* Stoddart and Gibbs (editors) Almost-Atoll of Aitutaki: Reef Studies in the Cook Islands, South Pacific. *A.R.B.* No. 190:149-158.

Unauthored check list of the collection of mollusk shells made by Judge H.J. Morgan from the Cook Islands.

Morrison, Joseph P. E.

1951. Atoll Research in Zoology, Land and Marine. *A.R.B.* No. 1:16-17.

The current state of knowledge about land and marine fauna on coral atolls and plea to concentrate on global systematics of fauna.

1953. The Berlese Method of Collecting Small Insects and Other Animals from Leafmold, Soil, Moss, or Other Similar Materials. *A.R.B.* No. 17:73.

Description of berlese method of collecting small insects.

Morrison, Joseph P. E. (cont)

1953. Collecting Mollusks On and Around Atolls. *A.R.B.* No. 17:74-77.
How to collect and preserve mollusks. Diagrams of equipment needed.

1954. Animal Ecology of Raroia Atoll, Tuamotus. *A.R.B.* No. 34:1-26.
Part I: notes on mollusks and other animals, Part II: notes on Birds of Raroia with Raroian names.

Morrison, R. J.

1990. Pacific Atoll Soils: Chemistry, Mineralogy and Classification. *A.R.B.* No. 339:1-25.
General description of atolls and soils. Analysis and classification of soils from select Pacific atolls. Comments about the differences between low and raised islands and the utility of the new soil taxonomy. Bibliography and tables.

Moul, Edwin T.

1954. Preliminary Report on Land Animals at Onotoa Atoll, Gilbert Islands. *A.R.B.* No. 28:1-28.
Description of land vertebrates (mammals, birds, and reptiles) and land invertebrates from Onotoa Atoll in the Gilberts. Discussion of ecology.

1957. Preliminary Report on the Flora of Onotoa Atoll, Gilbert Islands. *A.R.B.* No. 57:1-48.
Vegetation and flora of Onotoa Atoll, Gilberts. Gilbertese plant names.

1964. New Records of *Halimeda* and *Udotea* for the Pacific Area. *A.R.B.* No. 106:1-10.
Observations of green algae (*Halimeda* and *Udotea*) from Arno, the Northern Marshalls, Raroia, the Philippines, Johnston Island, the Hawaiian Islands, Kapingamarangi, Guam, Saipan, and Okinawa. Bibliography.

Moulton, James M.

1961. Some Observations on the Heron Island Fauna. *A.R.B.* No. 82:15-16.
Observations of whales, birds, rats, a gastropod (*Cerithium monifilerum*), and turtles on Heron Island, Great Barrier Reef.

Murai, Mary

1954. Nutrition Study in Micronesia. *A.R.B.* No. 27:1-239.
Nutrition studies of Majuro, Marshall Islands and Udot, Truk with comparative notes. Lists of foods, food habits and dietary patterns, survey results with emphasis on children, analysis of diet, and recommendations. Tables, Bibliography, local food names.

Murphy, Robert Cushman and Ernst Mayr

1951. Birds. *A.R.B.* No. 1:19-20.
What can be learned about birds from coral atoll research -- sea birds (Murphy) and land birds (Mayr).

Nason, James D.

1975. Reconnaissance and Plat Mapping of Coral Atolls: A Simplified Rangefinder Method. *In* Island News and Comment. *A.R.B.* No. 185:13-20.
Response to Domm (ARB 148:15-17) about simplified mapping using rangefinder techniques. Bibliography.

Neas, Maynard

1961. Land Ownership Patterns in the Marshall Islands. *In* Doran (editor) Land Tenure in the Pacific. *A.R.B.* No. 85:17-24.
Social, political and economic aspects of land tenure in the Marshalls. Land use patterns and rights and obligations of Marshallese. Difficulties of administration in present "chaotic" condition.

Neff, Johnson A. and Philip A. DuMont

1955. A Partial List of the Plants of the Midway Islands. *A.R.B.* No. 45:1-11.
List of plants found on Midway (Leeward islands of the Hawaiian chain) with habitats. Bibliography.

Newbery, D. McC. and M. G. Hill

1981. Numerical Classification of 'Mixed Scrub' Vegetation on Aldabra Atoll. *A.R.B.* No. 246:1-9.

Sampling of mixed scrub vegetation of Aldabra (Western Indian Ocean) to assess the infestation of the coccid, *Icerya seychellarum*. Bibliography and charts.

1985. Changes in the Distribution of the Coccid *Icerya seychellarum* (Westw.) on Aldabra Atoll in Relation to Vegetation Density. *A.R.B.* No. 291:1-11.

Documentation of increase in spatial distribution of coccids and degree of infestation of host trees on Aldabra (Western Indian Ocean). Map, tables, bibliography

Newbery, D. McC. and R. A. Spicer

1979. The Terrestrial Vegetation of an Indian Ocean Coral Island: Wilingili, Addu Atoll, Maldive Islands: A Limited Quantitative Analysis of the Vegetation Distribution. *A.R.B.* No. 231:15-25.

Study of the association between vegetation and environmental variables. Bibliography, maps and charts.

Newell, Norman D.

1954. Expedition to Raroia, Tuamotus. *A.R.B.* No. 31:1-22.

Background information on the Raroia expedition. General comments on the Tuamotus, and specific physical characteristics of Raroia. Maps, 2 bibliographies, diagrams.

1954. *A.R.B.* No. 36:1-35

Reefs and Sedimentary Processes of Raroia

Study of reef biota and sedimentation at Raroia with an appendix by J. Sperrazza on the distribution of foraminifera. Maps, charts, bibliography.

Newhouse, Jan

1954. Ecological and Floristic Notes on the Myxophyta of Raroia. *A.R.B.* No. 33:42-54.

Notes on collection of Blue-Green Algae collected from Raroia. Speculations on the role of blue-green algae in ecological systems.

1969. The Algae of Kapingamarangi Atoll, Caroline Islands. Part I. Checklist of the Cyanophyta, Chlorophyta, and Phaeophyta. *A.R.B.* No. 121:1-7.

Checklist of Cyanophyta, Chlorophyta, and Phaeophyta Algae from Kapingamarangi with notes on the ecological role of algae in coral reefs. Bibliography.

Ngan, Yinam and Ian R. Price

1979. The Intertidal Algae of the Mainland Coast in the Vicinity of Townsville, Queensland. *A.R.B.* No. 237:1-29.

Systematic list of algae recorded from eight stations near Townsville, Australia. Bibliography.

Niering, William A.

1956. Bioecology of Kapingamarangi Atoll, Caroline Islands: Terrestrial Aspects. *A.R.B.* No. 49:1-32.

Description of land biota of Kapingamarangi with reference to human utilization of plants and animals. Past vegetation and present trends. Maps, species lists, diagrams, and bibliography.

1961. Observations on Puluwat and Gaferut, Caroline Islands. *A.R.B.* No. 76:1-10.

Flora, geology, soils, vegetation and fauna of Puluwat, with speculation about the origin of the phosphate deposits on Gaferut. Bibliography and aerial photo.

Norman, F. I.

1967. The Identity of the Rats on Heron Island, Capricorn Group, Queensland, Australia Atoll News and Comment. *A.R.B.* No. 119:3-4.

Reevaluation of rats found on Heron Island. Determination of identity as *Rattus rattus*. Bibliography.

1975. The Murine Rodents *Rattus rattus exulans*, and *norvegicus* as Avian Predators. *A.R.B.* No. 182:1-13.

Concern that rats introduced by humans have been preying on birds on Pacific Islands with reference to bird-eating behavior of rats elsewhere. Bibliography.

Northrop, John

1962. Geophysical Observations on Christmas Island. *A.R.B.* No. 89:1-2.

Studies of magnetism and gravity, lagoon water, and other geophysical features of Christmas.

Odum, Eugene P. and Howard T. Odum

1957. Zonation of Corals on Japtan Reef, Eniwetok Atoll. *A.R.B.* No. 52:1-3.

Analysis of coral collected from transect across windward reef near Japtan in Enewetak. Diagram.

Ogden, Nancy B., William B. Gladfelter, John C. Ogden and Elizabeth H. Gladfelter

1985. Marine and Terrestrial Flora and Fauna Notes on Sombrero Island in the Caribbean. *A.R.B.* No. 292:61-74.

Observations of plant and animal life on Sombrero Island. Photographs, species lists, bibliography.

Parker, I. S. C.

1970. Some Ornithological Observations from the Western Indian Ocean. *In* Stoddart (editor) Coral Islands of the Western Indian Ocean. *A.R.B.* No. 136:211-220.

List of bird species collected or observed while at sea in Western Indian Ocean. Bibliography.

Paulay, Gustav

1987. Biology of Cook Islands Bivalves, Part I. Heterodont Families. *A.R.B.* No. 298:1-31.

Documentation of habitat specificity of heterodont bivalves and investigation of correlation between habitat specificity and distribution. Species list, tables, bibliography.

1989. Marine Invertebrates of the Pitcairn Islands: Species Composition and Biogeography of Corals, Molluscs, and Echinoderms. *A.R.B.* No. 326:1-27.

Description of corals, echinoderms, and mollusks found in the Pitcairn Group (Henderson, Oeno, Ducie, and Pitcairn). Discussion of biogeography of these marine communities. Bibliography and species lists.

Paulay, Gustav and T. Spencer

1989. Vegetation of Henderson Island. *A.R.B.* No. 328:1-13.

Description of 11 vegetation communities found on Henderson. Bibliography, diagram, photographs.

Peake, J. F.

1971. Non-Marine Mollusca of Diego Garcia. *In* Stoddart and Taylor (editors) Geography and Ecology of Diego Garcia Atoll, Chagos Archipelago. *A.R.B.* No. 149:173-174.

List of all non-marine mollusks recorded for Diego Garcia. Bibliography.

Peters, A. J. and J. F. G. Lionnet

1973. Central Western Indian Ocean Bibliography. *A.R.B.* No. 165:1-321.

Bibliography of literature on Western Indian Ocean (Seychelles, Aldabra Group, Farquhar Group, Agalega, and Chagos Archipelago) with subject, region, and taxa indices.

Peyrot-Clausade, Mireille

1981. Distribution of the Decapods Brachyura and Anomura (excluding Paguridae) of the Cryptofauna in the Reefs near Tulear. *A.R.B.* No. 255:101-112.

Survey of the distribution of Decapoda, Brachyura and Anomura (as part of larger study of cryptofauna) from reefs off Madagascar. Bibliography, tables, and maps.

Philippot, Véronique

1987. Annotated Checklist of the Gorgonacea from Martinique and Guadeloupe Islands (F.W.I.). *A.R.B.* No. 303:1-16.

Record of 75 species of Gorgonians from Martinique and Guadeloupe. Annotated check list and maps.

Pichon, Michel

1978. Recherches sur les Peuplements à Dominance d'Anthozoaires dans les Récifs Coralliens de Tuléar (Madagascar). *A.R.B.* No. 222:1-447.

Description of coral reefs off Madagascar. Presentation of biological-structural framework of coral reefs and specific analysis of colonization on top of a scleractinian infralittoral stratum. In French. Photographs, charts, graphs, and bibliography.

Piggott, C. J.

1961. Notes on some of the Seychelle Islands, Indian Ocean. *A.R.B.* No. 83:1-10.

Classification of islands in the Seychelle group (including the Amirantes, Aldabra, and Farquhar). Detailed descriptions of Alphonse, St. Pierre, Astove, and Desnoeufs. Maps, bibliography.

Pillai, C. S. Gopinadha

1971. The Distribution of Shallow-Water Stony Corals at Minicoy Atoll in The Indian Ocean With a Check-List of Species. *A.R.B.* No. 141:1-12.

Description of corals and coral reefs of the Minicoy Atoll at the south end of the Laccadive Archipelago. Systematic list of scleractinian coral. Maps and bibliography.

Pilling, Q. F.

1961. Land Tenure in Tonga. *In* Doran (editor) Land Tenure in the Pacific. *A.R.B.* No. 85:45-49.

Present land law of Tonga. Agricultural production. Adaptive value of land law for Tongans.

Poklington, R., P. R. Willis and M. Palmieri

1972. Birds Seen at Sea and on an Island in the Cargados Carajos Shoals. *A.R.B.* No. 158:1-8.

Sea birds noted in the Indian Ocean. Bibliography and appendix on birds breeding on Cargados Carajos Shoals.

Polhemus, D. A.

1990. Heteroptera of Aldabra Atoll and Nearby Islands, Western Indian Ocean, Part 1. Marine Heteroptera (Insecta); Gerridae, Veliidae, Hermatobatidae, Saldidae, and Omaniidae. *A.R.B.* No. 345:1-16.

Distribution of marine Heteroptera on Aldabra and Cosmoledo. Description of ecology, Identification of 3 zones characterized by distinct species assemblages. Speculation about role of SE monsoons. Key to marine species. Bibliography and maps.

Potts, D. C.

1978. Differentiation in Coral Populations. *In* Smith (editor) Coral Reef Ecosystems: Proceedings of Papers Presented at the 13th Pacific Science Congress, Vancouver. *A.R.B.* No. 220:55-74.

Measurement of variability in growth, survivorship and intraspecific interactions within a subgroup (*Isopora*) of genus *Acropora* from Heron Island. Estimation of relative roles of genetics and environment in phenotypic variability. Bibliography.

Potts, G. W.

1980. The Zonation of Rocky Littoral Areas Around Little Cayman. *In* Stoddart and Giglioli (editors) Geography and Ecology of Little Cayman. *A.R.B.* No. 241:23-42.
Survey of rocky littoral regions of Little Cayman and their molluskan fauna. Analysis of relationship between composition of mollusk species and degree of exposure of site. Charts, bibliography, maps and photographs.

1980. The Littoral Fishes of Little Cayman. *In* Stoddart and Giglioli (editors) Geography and Ecology of Little Cayman. *A.R.B.* No. 241:43-52.
Survey of littoral marine fish of Little Cayman with notes on habitats. Proposal of alternative scheme for classifying fish. Bibliography and diagram.

Pringle, James S.

1982. Floristic Observations on South Water and Carrie Bow Cays, Stann Creek District, Belize in 1979-1980. *A.R.B.* No. 259:1-10.
General description of South Water Cay and list of vascular plant species observed. Discussion of damage of Hurricane Hattie and mechanisms of plant dispersal and vegetation recovery. Bibliography and photographs.

Proctor, G. R.

1980. Checklist of the Plants of Little Cayman. *In* Stoddart and Giglioli (editors) Geography and Ecology of Little Cayman. *A.R.B.* No. 241:71-80.
Checklist of vascular plants of Little Cayman with indication of endemic species.

Prys-Jones, R. P., M. S. Prys-Jones and J. C. Lawley

1981. The Birds of Assumption Island, Indian Ocean: Past and Future. *A.R.B.* No. 248:1-16.
List of birds of Assumption Island and description of the original avifauna with estimates of time-frame and likely causes of its destruction. Assessment of importance of conservation on Assumption in light of recent bird introductions. Bibliography.

Randall, John E.

1953. Hints on Living on a Boat. *A.R.B.* No. 17:125-127.
Preparing for a safe, efficient and psychologically healthy voyage on a small boat.

1955. Fishes of the Gilbert Islands. *A.R.B.* No. 47:1-243.
Systematic list of fishes noted from Gilbert Islands, mostly Onotoa. Key to species of Apogonidae, Pomacentridae, Acanthuridae, Cirrhitidae, Balistidae, and Monocanthidae. Gilbertese fish names, bibliography.

Rapaport, Moshe

1990. Population Pressure on Coral Atolls: Trends and Approaching Limits. *A.R.B.* No. 340:1-33.
Discussion of atoll resources, economies and land tenure. Proposal of a dynamic measure of carrying capacity based on global economics and perception as well as locally derived food. Contrast of dependent and independent atolls. Bibliography and tables.

Rauzon, Mark J.

1985. Feral Cats on Jarvis Island: Their Effects and Their Eradication. *A.R.B.* No. 282:1-30.
Narrative of efforts to eradicate cats from Jarvis Is1982.. Need to preserve bird breeding site by eliminating bird predators. Map and bibliography.

Regnault, R. H.

1961. Land in Fiji. *In* Doran (editor) Land Tenure in the Pacific. *A.R.B.* No. 85:35-42.
Government policy regarding land tenure in Fiji. Rights of ethnic Fijians and ethnic Indians. Population figures.

Rehder, Harald A. and John E. Randall

1975. Ducie Atoll: Its History, Physiography and Biota. *A.R.B.* No. 183:1-40.

History of Ducie. Past and current scientific research there. General description of Ducie, specific descriptions of lagoon, channels, reefs, birds, reptiles, fishes, crustaceans, marine mollusks, echinoderms, and corals. Bibliography and photographs.

Renon, J.-P.

1987. Le Zooplancton du Lagon de Clipperton. *A.R.B.* No. 301:1-14.

Discussion of lagoonar planktonic communities of Clipperton with demographic data on predator *Acanthocyclops robustus* and prey *Latonopsis australis*. In French. Tables, maps and bibliography.

Rhyne, C. F.

1971. Marine Algae of Diego Garcia. *In* Stoddart and Taylor (editors) Geography and Ecology of Diego Garcia Atoll, Chagos Archipelago. *A.R.B.* No. 149:41-66.

Description of main algal habitats and collecting stations on Diego Garcia. Systematic list of algae known. Bibliography.

Richard, Georges

1985. Croissance et Production de *Chama iostoma* dans le Lagon de Takapoto, Tuamotu, Polynésie Française. *A.R.B.* No. 292:11-22.

A comparison of the productivity of three groups of mollusks with potential economic value in the Tuamotos. Special attention to the analysis of productivity of *Chama iostoma*. In French. Map, bibliography, tables.

Risk, Michael J.

1972. Fish Diversity on a Coral Reef in the Virgin Islands. *A.R.B.* No. 153:1-4.

Investigation of the relationship between substrate complexity in coral reefs and fish species diversity in the Virgin Islands. Charts and bibliography.

1981. Artificial Reefs in Discovery Bay, Jamaica. *A.R.B.* No. 255:91-100.

Attempts to create artificial reefs to improve fisheries in Discovery Bay, Jamaica with reports on economically desirable fish and crustacean species attracted. Bibliography, photographs, and map.

Roberts, Harry H.

1983. Shelf Margin Reef Morphology: A Clue to Major Off-Shelf Sediment Transport Routes, Grand Cayman Island, West Indies. *A.R.B.* No. 263:1-11.

Analysis of sediment accumulation and sediment transport patterns on Grand Cayman Island. Discussion of instrumentation. Description of morphology of off-shore shelf. Bibliography, maps, photographs, graphs, charts.

Robertson, I. A. D., S. A. Robertson and F. Raymond Fosberg

1983. List of Plants Collected on Alphonse Island, Amirantes. *In* Sachet, Stoddart, and Fosberg (editors) Floristics and Ecology of Western Indian Ocean Islands. *A.R.B.* No. 273:177-185.

Plant list for Alphonse Island, map and bibliography.

Robertson, S. A. and F. Raymond Fosberg

1983. List of Plants Collected on Coetivy Island, Seychelles. *In* Sachet, Stoddart, and Fosberg (editors) Floristics and Ecology of Western Indian Ocean Islands. *A.R.B.* No. 273:143-157.

Plant list for Coetivy Island, map and bibliography.

1983. List of Plants Collected on Platte Island, Seychelles. *In* Sachet, Stoddart, and Fosberg (editors) Floristics and Ecology of Western Indian Ocean Islands. *A.R.B.* No. 273:157-164.

Plant list for Platte Island, map and bibliography.

Robertson, S. A. and F. Raymond Fosberg (cont)

1983. List of Plants of Poivre Island, Amirantes. *In* Sachet, Stoddart, and Fosberg (editors) Floristics and Ecology of Western Indian Ocean Islands. *A.R.B.* No. 273:165-176.

List of plants collected or noted for Poivre Islands (Poivre and Ile du Sud) in the Amirantes. Map and bibliography.

Robertson, S. A. and C. M. Todd

1983. Vegetation of Fregate Island, Seychelles. *In* Sachet, Stoddart, and Fosberg (editors) Floristics and Ecology of Western Indian Ocean Islands. *A.R.B.* No. 273:39-64.

General description of Fregate Island in the Seychelles. Description of vegetation types and list of plants observed there with Creole and English common names. Bibliography and map.

Rogers, D. P.

1951. Fungi. *A.R.B.* No. 1:15.

The current state of knowledge about fungi on coral atolls.

1953. Suggestions for Collecting Fungi. *A.R.B.* No. 17:57-60.

How to identify different parasitic and non-parasitic fungi and how to preserve specimens.

Rosen, Brian Roy

1971. Annotated Check List and Bibliography of Corals of the Chagos Archipelago (including the Recent Collection from Diego Garcia), with Remarks on Their Distribution. *In* Stoddart and Taylor (editors) Geography and Ecology of Diego Garcia Atoll, Chagos Archipelago. *A.R.B.* No. 149:67-88.

Remarks on coral fauna from Chagos Archipelago. Check list of species collected by three collectors. Bibliography.

1979. Check list of Recent Coral Records from Aldabra (Indian Ocean). *A.R.B.* No. 233:1-24.

Remarks on coral fauna from Aldabra and list of all published coral records. Bibliography and chart.

Russell, Martin

1953. Collecting Geological Data. *A.R.B.* No. 17:16-18.

Basic concepts of geology necessary to make helpful observations of the geology of coral reefs and atolls.

Sachet, Marie-Hélène

1953. Scorpions on Coral Atolls. *A.R.B.* No. 26:1-10.

Information about scorpions on atolls. List of species of scorpions found and description of their habitats and ranges. Bibliography.

1954. A Summary of Information on Rose Atoll. *A.R.B.* No. 29:1-25.

Summary of information from literature for Rose Atoll. Includes geography, history, meteorology, geology, soils, land flora, vegetation and fauna. Bibliography.

1955. Pumice and Other Extraneous Volcanic Materials on Coral Atolls. *A.R.B.* No. 37:1-27.

Documented cases of pumice floating onto coral atolls throughout the Pacific and Indian Ocean. Historic references, chemical analysis, and sources proposed. Bibliography.

1957. Climate and Meteorology of the Gilbert Islands. *A.R.B.* No. 60:1-4.

Summary of climatic conditions with tables of rainfall. Bibliography.

1961. Historical and Climatic Information on Gaferut Island. *A.R.B.* No. 76:11-15.

History of Gaferut with short discussion of soils, geology, and climate. Bibliography.

Sachet, Marie-Hélène (cont)

1962. Geography and Land Ecology of Clipperton Island. *A.R.B.* No. 86:1-115.
Summary of geologic and ecological conditions on Clipperton with a catalog of land and lagoon plants and animals. Bibliography, maps and charts.

1969. List of Vascular Flora of Rangiroa. *A.R.B.* No. 125:33-44.
Plant list for Rangiroa.

1974. State of Knowledge of Coral Reefs as Ecosystems. *In* Sachet and Dahl (editors) Comparative Investigations of Tropical Reef Ecosystems: Background for an Integrated Coral Reef Program. *A.R.B.* No. 172:121-169.
Brief review of current knowledge and theories of coral reef ecosystems including geology, biotic environment and human influences. Lengthy bibliography.

1983. Natural History of Mopelia Atoll, Society Islands. *A.R.B.* No. 274:1-37.
General description of Mopelia, history, setting, substratum, land and marine vegetation, and fauna. List of Marine Mollusks (by Harald Rehder) and systematic list of terrestrial flora. Map, bibliography, and photographs.

1983. Botanique de l'île de Tupai, Iles de la Société. *A.R.B.* No. 276:1-26.
History, geography, vegetation, and list of plants collected or observed on Tupai. Partly in French, partly in English. Bibliography, maps, and photographs.

1983. Takapoto Atoll, Tuamotu Archipelago: Terrestrial Vegetation and Flora. *A.R.B.* No. 277:1-44.
Geography, climate, discovery, exploration, vegetation, fauna, and systematic list of land plants with annotations and native names. Bibliography, maps, and photographs.

Sachet, Marie-Hélène and Arthur Dahl (editors)

1974. Comparative Investigations of Tropical Reef Ecosystems: Background for an Integrated Coral Reef Program. *A.R.B.* No. 172:1-169.
Collection of papers about research on coral reef ecosystems.

Sachet, Marie-Hélène and F. Raymond Fosberg

1983. An Ecological Reconnaissance of Tetiaroa Atoll, Society Islands. *A.R.B.* No. 275:1-67.
General description, ecological setting and vegetation of Tetieroa. Observations regarding plant and animal pests and freshwater sources. Recommendations for appropriate tourist development. Annotated list of plants. Map, bibliography and photographs.

Sachet, Marie-Hélène, David R. Stoddart and F. Raymond Fosberg (editors)

1983. Floristics and Ecology of Western Indian Ocean Islands. *A.R.B.* No. 273:1-253.
Collection of papers pertaining to vegetation and ecology of some Western Indian Ocean Islands including: Cousin, Fregate, Agalega, Coetivy, Platte, Poivre, Alphonse, Marie- Louise, Desnoeufs, and Aldabra.

Scheer, Georg

1959. Contribution to a German Reef Terminology. *A.R.B.* No. 69:1-4.
Glossary of German terms describing characteristics of reefs as a basis for Reef Terminology Index which NAS/NRC was preparing.

Schubel, Susan E. and David W. Steadman

1989. More Bird Bones From Polynesian Archeological Sites on Henderson Island, Pitcairn Group, South Pacific. *A.R.B.* No. 325:1-14.
Study of bird bones found in archeological sites in limestone caves on Henderson. Suggestions of extinctions of five species of seabirds and three species of landbirds since human settlement. Appendix by Melinda Allen, bibliography, bird lists, maps.

Schultz, Leonard P.

1953. Directions for Collecting, Preserving, and Shipping Fishes. *A.R.B.* No. 17:90-95.
Collecting fish using rotenone and lights at night. Preserving fish for shipment.

Scott, G. A. J. and G. M. Rotondo

1983. A Model for the Development of Types of Atolls and Volcanic Islands on the Pacific Lithospheric Plate. *A.R.B.* No. 260:1-33.
A model to explain the development of all major Pacific plate island types with literature review. Bathymetric data, charts, maps, diagrams, profiles, bibliography.

Sheppard, C. R. C.

1987. Coral Species of the Indian Ocean and Adjacent Seas: A Synonymized Compilation and Some Regional Distributional Patterns. *A.R.B.* No. 307:1-32.
List of coral hermatypic coral species from 24 locations in the Indian Ocean and peripheral seas and gulfs with cluster analysis showing three broad geographic groupings. Species lists, maps, and bibliography.

Sigee, D. C.

1966. Preliminary Account of the Land and Marine Vegetation of Addu Atoll. *In* Stoddart (editor) Reef Studies at Addu Atoll, Maldive Islands: Preliminary Results of an Expedition to Addu Atoll 1964.. *A.R.B.* No. 116:61-74.
Land and marine vegetation from Gan and Hitaddu Islets of Addu Atoll. Notes on occurrences of algae. Map and graphs.

Sims, R.

1971. Earthworms of Diego Garcia. *In* Stoddart and Taylor (editors) Geography and Ecology of Diego Garcia Atoll, Chagos Archipelago. *A.R.B.* No. 149:171.
List of the four species of earthworm collected on Diego Garcia.

Sivadas, P., B. Narayanan and K. Sivaprasad

1983. An Account of the Vegetation of Kavaratti Island, Laccadives. *A.R.B.* No. 266:1-9.
A short account of climatic conditions and soil chemistry and a description of the vegetation of Kavaratti Island. Plant lists, bibliography, maps, photographs.

Smith, Celia M. and James N. Norris

1988. Procarp Structure in Some Caribbean Species of Bostrychia Montagne (Rhodophyta, Rhodomelaceae): An Important Systematic Character. *A.R.B.* No. 312:1-15.
Pre-fertilization procarp structures in species of red algae contribute more than simply vegetative characteristics to the systematics of species of Bostrychia. Photographs and bibliography.

Smith, S. V.

1974. Introduction. CITRE and IMSWE Studies in British Honduras. *In* Sachet and Dahl (editors) Comparative Investigations of Tropical Reef Ecosystems: Background for an Integrated Coral Reef Program. *A.R.B.* No. 172:1-6.
The beginning of an integrated coral reef program: "Comparative Investigations of Tropical Reef Ecosystems" in British Honduras and a more specific project called "Investigations of Marine Shallow-Water Ecosystems". Personnel list.

Smith, S. V. (editor)

1978. Coral Reef Ecosystems: Proceedings of Papers Presented at the 13th Pacific Science Congress, Vancouver. *A.R.B.* No. 220:1-110.
Collection of papers presented in the Systems Modelling and Coral Reef Ecosystems symposium at the 13th Pacific Science Congress in 1975.

Smith, S. V. and R. S. Henderson (editors)
1978. Phoenix Islands Report I: An Environmental Survey of Canton Atoll Lagoon, 1973. *A.R.B.* No. 221:1-183.
Collection of articles on aspects of ecology in Canton Island Lagoon.

Smith, S. V. and P. L. Jokiel
1978. Water Composition and Biochemical Gradients in the Canton Atoll Lagoon. *In* Smith and Henderson (editors) Phoenix Islands Report I: An Environmental Survey of Canton Atoll Lagoon, 1973. *A.R.B.* No. 221:15-54.
Budgets of water, salt, nutrients, CO2, suspended material, and sediments used to establish dynamics of water exchange, biogeochemical reactions, and sedimentation in Canton lagoon. Maps, charts, bibliography.

Smith, S. V., P. L. Jokiel and G. S. Key
1978. Biogeochemical Budgets in Coral Reef Systems. *In* Smith (editor) Coral Reef Ecosystems: Proceedings of Papers Presented at the 13th Pacific Science Congress, Vancouver. *A.R.B.* No. 220:1-12.
Understanding of dynamics of coral reef ecosystems through studies of mass-balance budgets considering CaCO3 budget, organic Carbon budget, and nutrient budgets. Bibliography.

Smith, W. A.
1971. Crustacea: Cirripedes from Diego Garcia. *In* Stoddart and Taylor (editors) Geography and Ecology of Diego Garcia Atoll, Chagos Archipelago. *A.R.B.* No. 149:103-104.
A list of the three cirripede crustaceans noted from Diego Garcia: one recorded in 1909 and the other two on the current expedition (1967).

Sparrow, F. K.
1953. Collection of Soil Samples for the Recovery of Aquatic Phycomytes. *A.R.B.* No. 17:61.
Equipment needed, collection method and desirable data related to aquatic phycomycetes.

Spencer, T.
1989. Tectonic and Environmental Histories in the Pitcairn Group, Palaeogene to Present: Reconstructions and Speculations. *A.R.B.* No. 322:1-22.
New reconstructions of the tectonic history of Henderson Island and the Pitcairn group derived from remote sensing technology and improved sea floor mapping. Bibliography, maps, charts and photographs.

1989. Sediments and Sedimentary Environments of Henderson Island. *A.R.B.* No. 324:1-10.
Analysis of sediment samples from Henderson Island and suggestions of biogeographic gradients and island development. Appendix by Owen Green, bibliography, maps, graphs, and photographs.

Spencer, T. and Gustav Paulay
1989. Geology and Geomorphology of Henderson Island. *A.R.B.* No. 323:1-18.
Observations and hypotheses about the structure and geologic history of Henderson. Results of survey of fossil lagoon and fossil coral fauna. Suggestion of Pleistocene age for deposits. Bibliography, maps, cross-sections, and photographs.

Sperrazza, J.
1954. Distribution of Foraminifera. *Appendix to* Newell, Norman "Reefs and Sedimentary Processes of Raroia". *A.R.B.* No. 36:27-32.
Distribution of foraminifera around Raroia in the Tuamotus.

Spicer, R. A. and D. McC. Newbery

1979. The Terrestrial Vegetation of an Indian Ocean Coral Island: Wilingili, Addu Atoll, Maldive Islands: Transect Analysis of the Vegetation. *A.R.B.* No. 231:1-14.

Study of vegetation across three transects of Wilingili Islet, Addu Atoll in the Maldives. Notes on ground water quality. List of plants collected. Bibliography, charts, and maps.

Spoehr, Alexander

1951. Coral Atolls and Man. *A.R.B.* No. 1:21.

Why coral atoll research is important to people – argument for cultural ecological perspective and recommendations for research relating to environment and culture.

1953. Anthropology and Coral Atoll Field Research. *A.R.B.* No. 17:109-110.

Identification of high priority research topics for the study of human and cultural ecology of atoll populations.

Staub, F.

1970. Geography and Ecology of Tromelin Island. *In* Stoddart (editor) Coral Islands of the Western Indian Ocean. *A.R.B.* No. 136:197-210.

Description of topography, history, vegetation, fauna (inc birds), and human settlement of Tromelin. Map, photographs, and bibliography.

Stoddart, David R.

1962. Three Caribbean Atolls: Turneffe Islands, Lighthouse Reef, and Glover's Reef, British Honduras. *A.R.B.* No. 87:1-151.

Description of cays off Belize with discussion of geomorphology, reef ecology, climate, flora, and theories on the formation of this system of reefs and islands. Plant list, bibliography, maps.

1963. Effects of Hurricane Hattie on the British Honduras Reefs and Cays October 30-31, 1961. *A.R.B.* No. 95:1-142.

Damage done by Hurricane Hattie among the cays off British Honduras (Belize). Maps, graphs, diagrams, bibliography.

1964. Carbonate Sediments of Half Moon Cay, British Honduras. *A.R.B.* No. 104:1-16.

Analysis of sediments from Half Moon Cay, British Honduras (Belize). Suggests classification system based on size, sorting characteristics and organic derivation. Bibliography, maps, and frequency graphs.

1967. Scientific Studies on Aldabra Atoll. *A.R.B.* No. 118:1-8.

General comments on island ecology. Summary of previous and on-going scientific research on Aldabra.

1967. Summary of the Ecology of Coral Islands North of Madagascar. *A.R.B.* No. 118:53-61.

General ecological descriptions of Assumption, Astove, Gloriosa, Cosmoledo, Farquhar, St. Pierre, and Providence. Maps.

1967. Bibliography of Aldabra. *A.R.B.* No. 118:126-141.

Bibliography of literature of Aldabra geology, geomorphology, and biota.

1969. Reconnaissance Geomorphology of Rangiroa Atoll, Tuamotu Archipelago. *A.R.B.* No. 125:1-32.

Geomorphology of Rangiroa Atoll in the Tuamotus focussing on sources of consolidated and unconsolidated sediments, surface features of seaward reef flats. Tentative geomorphic history is offered. Bibliography, maps and photographs.

Stoddart, David R. (cont)

1969. Post-Hurricane Changes on the British Honduras Reefs and Cays: Re-Survey of 1965. *A.R.B.* No. 131:1-25.

Resurvey of British Honduras (Belize) Reefs and Cays 4 years after Hurricane Hattie with reference to the degree of recovery of the coral reefs and vegetation. Maps and bibliography.

1971. Rainfall on Indian Ocean Coral Islands. *A.R.B.* No. 147:1-21.

Study of rainfall on the Coral islands of the Indian Ocean: spatial and temporal distributions. Bibliography, charts, graphs, and maps.

1971. Scientific Studies at Diego Garcia Atoll. *In* Stoddart and Taylor (editors) Geography and Ecology of Diego Garcia Atoll, Chagos Archipelago. *A.R.B.* No. 149:1-6.

History of scientific research on Diego Garcia and description of goals and structure of British Ministry of Defense hydrographic survey expedition on H.M.S. Vidal.

1971. Geomorphology of Diego Garcia Atoll. *In* Stoddart and Taylor (editors) Geography and Ecology of Diego Garcia Atoll, Chagos Archipelago. *A.R.B.* No. 149:7-26.

General structure of Diego Garcia. Geomorphology of the land rim including the Barachois rim, lagoon mouth islands and sand dunes. Discussion of beachrock. Geomorphology of seaward reefs and lagoon. Maps, diagrams, and photographs.

1971. Land Vegetation of Diego Garcia. *In* Stoddart and Taylor (editors) Geography and Ecology of Diego Garcia Atoll, Chagos Archipelago. *A.R.B.* No. 149:127-142.

Terrestrial vegetation of Diego Garcia with reference to human settlements. Map and photographs,

1971. Terrestrial Fauna of Diego Garcia and Other Chagos Atolls. *In* Stoddart and Taylor (editors) Geography and Ecology of Diego Garcia Atoll, Chagos Archipelago. *A.R.B.* No. 149:163-170.

Account of all terrestrial fauna noted for Diego Garcia.

1971. Settlement and Development of Diego Garcia. *In* Stoddart and Taylor (editors) Geography and Ecology of Diego Garcia Atoll, Chagos Archipelago. *A.R.B.* No. 149:209-217.

History of discovery and settlement of Chagos Group by Europeans with notes on economic development and the introductions of plants and animals. Maps and photographs.

1971. Bibliography of Diego Garcia. *In* Stoddart and Taylor (editors) Geography and Ecology of Diego Garcia Atoll, Chagos Archipelago. *A.R.B.* No. 149:219-327.

Bibliography of Chagos Archipelago and Diego Garcia, in particular.

1972. Reef Islands of Rarotonga. *A.R.B.* No. 160:1-7.

Reef geomorphology and vegetation summary of Rarotongan reef islands. Bibliography.

1975. Sand Cays of Tongatapu. *A.R.B.* No. 181:1-8.

Descriptions of Makaha'a, Pangaimotu, Manima, and Oneata, off Tongatapu. Bibliography, maps, and photographs.

1975. Scientific Studies in the Southern Cook Islands: Background and bibliography. *In* Stoddart and Gibbs (editors) Almost-Atoll of Aitutaki: Reef Studies in the Cook Islands, South Pacific. *A.R.B.* No. 190:1-30.

Structure, topography and climate of islands in the Southern Cooks. History of European contact with Southern Cooks and discussion of previous scientific research there. Very extensive bibliography, maps, charts and illustrations.

Stoddart, David R. (cont)

1975. Almost-Atoll of Aitutaki: Geomorphology of Reefs and Islands. *In* Stoddart and Gibbs (editors) Almost-Atoll of Aitutaki: Reef Studies in the Cook Islands, South Pacific. *A.R.B.* No. 190:31-58.

Definition of "almost-atoll" and application of term to Aitutaki. Morphology and zonation of reefs, lagoon and reef islands. Discussion of explanations for "Makatea" formations in Southern Cooks. Maps, charts, photographs, and bibliography.

1975. Reef Islands of Aitutaki. *In* Stoddart and Gibbs (editors) Almost-Atoll of Aitutaki: Reef Studies in the Cook Islands, South Pacific. *A.R.B.* No. 190:59-72.

Description of the main physiographic features and vegetation of 16 of the smaller islands of Aitutaki. Maps and bibliography.

1975. Vegetation and Floristics of the Aitutaki Motus. *In* Stoddart and Gibbs (editors) Almost-Atoll of Aitutaki: Reef Studies in the Cook Islands, South Pacific. *A.R.B.* No. 190:87-116.

Vegetation and flora of the reef islands of Aitutaki with notes comparing these low islands with atoll islets and offering explanations for their relative paucity of species. Photographs, map and bibliography.

1975. Mainland Vegetation of Aitutaki. *In* Stoddart and Gibbs (editors) Almost-Atoll of Aitutaki: Reef Studies in the Cook Islands, South Pacific. *A.R.B.* No. 190:117-122.

Vegetation of main island of Aitutaki. Photographs.

1980. Scientific Survey of Little Cayman. *In* Stoddart and Giglioli (editors) Geography and Ecology of Little Cayman. *A.R.B.* No. 241:1-10.

General description of climatic characteristics of Little Cayman and history of scientific research there. Bibliography.

1980. Geology and Geomorphology of Little Cayman. *In* Stoddart and Giglioli (editors) Geography and Ecology of Little Cayman. *A.R.B.* No. 241:11-16.

Description of rock units and land forms of Little Cayman Island. Maps, charts, photographs, and bibliography.

1980. Vegetation of Little Cayman. *In* Stoddart and Giglioli (editors) Geography and Ecology of Little Cayman. *A.R.B.* No. 241:53-70.

Description of vegetation zones of Little Cayman. Bibliography, maps, and photographs.

1981. History of Goats in the Aldabra Archipelago. *A.R.B.* No. 255:23-26.

Summary of the history of goats on Aldabra with reference to goats on other nearby islands. Bibliography.

1981. Abbott's Booby on Assumption. *A.R.B.* No. 255:27-32.

Records of Abbott's booby on Assumption up to 1908 and questions about its existence in Iles Glorieuses. Remarks on extinction. Bibliography.

1983. Introduction. *In* Sachet, Stoddart, and Fosberg (editors) Floristics and Ecology of Western Indian Ocean Islands. *A.R.B.* No. 273:1-6.

Introduction to collected papers on vegetation and ecology of Western Indian Ocean islands.

1983. Spatial and Temporal Variability of Rainfall on Aldabra Atoll. *In* Sachet, Stoddart, and Fosberg (editors) Floristics and Ecology of Western Indian Ocean Islands. *A.R.B.* No. 273:223-246.

Discussion of rainfall on Aldabra and the variability in rainfall within the atoll due to wind direction, small precipitation events, and the coincidence of cumulus development with atoll locations. Maps, charts, and bibliography.

Stoddart, David R. (cont)

1980. Little Cayman: Ecology and Significance. *In* Stoddart and Giglioli (editors) Geography and Ecology of Little Cayman. *A.R.B.* No. 241:171-180.

Summary of conclusions of component volume papers to serve as guidelines for economic development plans. Summary of species extinctions and endangered species, and summary of threatened habitats. Bibliography and maps.

Stoddart, David R. (editor)

1966. Reef Studies at Addu Atoll, Maldive Islands: Preliminary Results of an Expedition to Addu Atoll in 1964. *A.R.B.* No. 116:1-122.

Detailed study of Addu Atoll – climate, geomorphology, corals, vegetation and flora, and history. Maps and bibliography.

1967. Ecology of Aldabra Atoll, Indian Ocean. *A.R.B.* No. 118:1-141.

Collection of papers on the ecology of Aldabra. Photographs.

1970. Coral Islands of the Western Indian Ocean. *A.R.B.* No. 136:1-224.

Collection of papers on coral islands in the Western Indian Ocean including history of scientific research. Bibliography.

Stoddart, David R. and C. W. Benson

1970. An Old Record of a Blue Pigeon *Alectroenas* species and Sea-Birds on Farquhar and Providence. *In* Stoddart (editor) Coral Islands of the Western Indian Ocean. *A.R.B.* No. 136:35-36.

Records from a 1821 explorer concerning a blue pigeon *Alectroenas* species on Farquhar and Providence. Bibliography.

Stoddart, David R., C. W. Benson and J. F. Peake

1970. Ecological Change and Effects of Phosphate Mining on Assumption Island. *In* Stoddart (editor) Coral Islands of the Western Indian Ocean. *A.R.B.* No. 136:121-146.

History of scientific research on Assumption. Descriptions of topography, climate, vegetation, fauna, human settlement and exploitation of phosphate. Discussion of impact of phosphate mining on ecology. Bibliography, photographs, and map.

Stoddart, David R., M. J. Coe and F. Raymond Fosberg

1979. D'Arros and St. Joseph, Amirante Islands. *A.R.B.* No. 223:1-48.

Geography and Ecology of D'Arros Island, Plants of D'Arros Island, Geography and Ecology of St. Joseph Atoll, and Plants of St. Joseph Atoll. Maps, 3 bibliographies, and photographs.

Stoddart, David R., P. Spencer Davies and A. C. Keith

1966. Geomorphology of Addu Atoll. *In* Stoddart (editor) Reef Studies at Addu Atoll, Maldive Islands: Preliminary Results of an Expedition to Addu Atoll in 1964. *A.R.B.* No. 116:13-42.

General description of Addu Atoll, its reefs, lagoon, islands, sediments, with special reference to the historic controversy over the infilling of Addu lagoon. Diagrams and maps.

Stoddart, David R. and F. Raymond Fosberg

1972. South Indian Sand Cays. *A.R.B.* No. 161:1-16.

Description of cays that connect Ceylon to India (Adam's Bridge). Environment, vegetation, and flora. Maps and bibliography.

1981. Bird and Denis Islands, Seychelles. *A.R.B.* No. 252:1-50.

Geography, ecology and flora of Bird and Denis Islands in the Seychelles. Maps, photographs, and bibliography.

Stoddart, David R. and F. Raymond Fosberg (cont)

1981. Topographic and Floristic Change, Dry Tortugas, Florida 1904-1977. *A.R.B.* No. 253:1-54.
List of Dry Tortugas plants with comments on island size estimates, the relationship between area and floristic diversity, and the problems of colonization and extinction. Bibliography, tables, maps, and photographs.

Stoddart, David R., F. Raymond Fosberg and Marie-Hélène Sachet

1982. Ten Years of Change on the Glover's Reef Cays. *A.R.B.* No. 257:1-17.
Review of scientific studies of Glover's Reef, Belize. Morphology and vegetation surveys in 1961 and 1971. List of recorded terrestrial plants. Discussion of factors relating to species diversity. Maps, photographs, and bibliography.

Stoddart, David R., F. Raymond Fosberg and D. L. Spellman

1982. Cays of the Belize Barrier Reef and Lagoon. *A.R.B.* No. 256:1-73.
General description of cays of the barrier reef and coastal shelf of Belize (British Honduras). Plant species reported for each island. Accounts of damage from Hurricane Hattie (1962). Maps, photographs, island index, and bibliography.

Stoddart, David R., P. E. Gibbs and D. Hopley

1981. Natural History of Raine Island, Great Barrier Reef. *A.R.B.* No. 254:1-44.
General description of Raine Island, Great Barrier Reef. Geology and geomorphology, fresh water, vegetation and flora, fauna (esp. birds) and discussion of human disturbances. Photographs, illustrations, maps, and bibliography.

Stoddart, David R. and P. E. Gibbs (editors)

1975. Almost-Atoll of Aitutaki: Reef Studies in the Cook Islands, South Pacific. *A.R.B.* No. 190:1-158.
Collection of papers on the physical and biotic features of Aitutaki "almost-atoll" in the Southern Cooks.

Stoddart, David R. and M. E. C. Giglioli (editors)

1980. Geography and Ecology of Little Cayman. *A.R.B.* No. 241:1-180.
Collection of papers relating to Little Cayman Island.

Stoddart, David R. and L. U. Mole

1977. Climate of Aldabra Atoll. *A.R.B.* No. 202:1-21.
Description of atmospheric pressure, winds, temperature, and rainfall on Aldabra with charts giving monthly readings for these variables from 1967 to 1974. Graphs and bibliography.

Stoddart, David R. and M. E. D. Poore

1970. Geography and Ecology of Farquhar Atoll. *In* Stoddart (editor) Coral Islands of the Western Indian Ocean. *A.R.B.* No. 136:7-26.
History of scientific research on Farquhar. Descriptions of island geomorphology, vegetation, fauna, bird lists, and human settlement. Bibliography and photographs.

1970. Geography and Ecology of Desroches. *In* Stoddart (editor) Coral Islands of the Western Indian Ocean. *A.R.B.* No. 136:155-166.
History of scientific research on Desroches. Descriptions of vegetation, fauna, and human settlement. Map, bibliography, and photographs.

1970. Geography and Ecology of Remire. *In* Stoddart (editor) Coral Islands of the Western Indian Ocean. *A.R.B.* No. 136:171-182.
History of scientific research on Remire. Description of vegetation, fauna, and human settlement. Map and bibliography.

Stoddart, David R. and M. E. D. Poore (cont)

1970. Geography and Ecology of African Banks. *In* Stoddart (editor) Coral Islands of the Western Indian Ocean. *A.R.B.* No. 136:187-192.

History of scientific research on African Banks. Description of vegetation, fauna, and human settlement. Map and bibliography.

Stoddart, David R. and T. P. Scoffin

1979. Microatolls: Review of Form, Origins and Terminology. *A.R.B.* No. 224:1-17.

Summary of the literature on micro-atolls offering a general definition and set of characteristics. Speculation about origins. Bibliography.

Stoddart, David R. and T. Spencer

1987. Rurutu Reconsidered: The Development of Makatea Topography in the Austral Islands. *A.R.B.* No. 297:1-19.

Arguments for the erosional origin of rims of elevated mid- Tertiary limestones in the Southern Cooks and Australs (makatea). Comparison of Rurutu with other more typical islands. Maps, tables, photographs, tables, bibliography.

Stoddart, David R. and J. D. Taylor (editors)

1971. Geography and Ecology of Diego Garcia Atoll, Chagos Archipelago. *A.R.B.* No. 149:1-237.

Collection of 19 papers on the terrestrial and marine environment of Diego Garcia.

Stoddart, David R., C. D. Woodroffe and T. Spencer

1990. Mauke, Mitiaro and Atiu: Geomorphology of Makatea Islands in the Southern Cooks. *A.R.B.* No. 341:1-65.

Geomorphological description of volcanic and limestone features of islands in S. Cooks with thoughts on makatea formation, lithospheric flexure and sea level changes. Bibliography, photographs, and diagrams.

Stoddart, David R. and C. A. Wright

1967. Geography and Ecology of Aldabra Atoll. *A.R.B.* No. 118:11-52.

Description of geomorphology, geology, flora, vegetation, terrestrial and marine fauna, and human settlements on Aldabra. Maps.

Stone, Earl L.

1951. Soils. *A.R.B.* No. 1:12.

A summary of the present state of knowledge and suggestions for future research in pedology (soil development) and edaphology (soil in relation to plants).

1951. Agriculture. *A.R.B.* No. 1:22.

Meager state of knowledge of agriculture on coral atolls except cultivation of coconuts for export. Future research should be directed to encouraging agricultural development of coral atolls.

1951. The Soils of Arno Atoll, Marshall Islands. *A.R.B.* No. 5:1-56.

Physical factors and biological factors of soil formation. Characteristics of soils on Arno. Maps and tables.

1951. The Agriculture of Arno Atoll, Marshall Islands. *A.R.B.* No. 6:1-46.

Description of utilitarian plants of Arno with native names.

1953. Soil Science. *A.R.B.* No. 17:38-43.

Objectives and methods of soil collection with definition of terms and concepts in soil science.

1953. Summary of Information on Atoll Soils. *A.R.B.* No. 22:1-5.

Properties of atoll soils and sequence of soil development.

Svihla, Arthur

1957. Observations on French Frigate Shoals, February 1956. *A.R.B.* No. 51:1-2.

Brief observations of vegetation and terrestrial vertebrates of Tern Island in the French Frigate Shoals (Leeward islands of the Hawaiian chain).

Taylor, J. D.

1971. Observations on the Shallow-Water Marine Fauna. *In* Stoddart and Taylor (editors) Geography and Ecology of Diego Garcia Atoll, Chagos Archipelago. *A.R.B.* No. 149:31-40.

Description of main near-shore marine habitats and the dominant animal species found. Diagrams.

1971. Crustacea: Brachyura and Anomura from Diego Garcia. *In* Stoddart and Taylor (editors) Geography and Ecology of Diego Garcia Atoll, Chagos Archipelago. *A.R.B.* No. 149:93-102.

List of collections of Brachyura and Anomura Crustaceans from Diego Garcia. Bibliography.

1971. Marine Mollusca from Diego Garcia. *In* Stoddart and Taylor (editors) Geography and Ecology of Diego Garcia Atoll, Chagos Archipelago. *A.R.B.* No. 149:105-126.

Systematic list of marine mollusks found around Diego Garcia with notes on their habitats. Bibliography.

Taylor, William Randolph

1975. Marine Algae of Great Swan Island. *In* Island News and Comment. *A.R.B.* No. 185:6-10.

List of algae collected from Great Swan Island off the coast of Honduras. Bibliography.

1977. Notes on Plants of the Genus *Caulerpa* in the Herbarium of Maxwell S. Doty at the University of Hawaii. *A.R.B.* No. 208:1-17.

Summary of research to rectify determinations and organize the genus *Caulerpa* (green algae) in the Maxwell Doty collection at the University of Hawaii. List of all holdings by species and provenience. Bibliography.

1977. Marine Algae of the Te Vega 1965 Expedition in the Western Pacific Ocean. *A.R.B.* No. 209:1-16.

Itinerary and description of collecting stations of the Te Vega Expedition of Stanford University. List of algae collected. Bibliography.

Temme, Manfred

1985. First Records of Wood Sandpiper, Ruff and Eurasian Tree Sparrow from the Marshall Islands. *A.R.B.* No. 292:23-28.

Observations of straggler species of migratory birds and introduced Eurasian birds in the Marshall Islands. Bibliography and photographs.

Thaman, R. R.

1987. Plants of Kiribati: A Listing and Analysis of Vernacular Names. *A.R.B.* No. 296:1-42.

Comments on utility of vernacular names, a discussion of cognitive systematics and the derivation of Gilbertese terms, and summary of previous studies. Plant lists and bibliography.

1990. Kiribati Agroforestry: Trees, People and the Atoll Environment. *A.R.B.* No. 333:1-29.

Description of agroforestry on Tarawa and Abemama with discussion on role of trees in agriculture, as symbols of stability, as sources of useful products, and as components in the ecological system.

Thibault, Jean-Claude and Isabelle Guyot

1987. Recent Changes in the Avifauna of Makatea Island (Tuamotus, Central Pacific). *A.R.B.* No. 300:1-13.

Documentation of changes in avifauna on Makatea that have resulted from phosphate mining and deforestation. Reference to endangered Society Islands Imperial Pigeon (*Ducula aurorae*). Bibliography and tables.

Thomas, John Byron and Mary Durand Thomas

1981. Meteorological Data from Ulul Island, Namonuito Atoll. *A.R.B.* No. 255:39-42.

Meteorological observations (temperatures, relative humidity, and rainfall) from Ulul Island, Namonuito Atoll in the Central Caroline Islands. Table.

Tirvengadum, D. D. and R. Bour

1985. Checklist of the Herpetofauna of the Mascarene Islands. *A.R.B.* No. 292:49-60.

Observations of reptiles and amphibians of Mascarene Islands including comment on subfossil collections and observations made by earlier expeditions. Maps, species list, bibliography.

Tobin, Jack

1952. Land Tenure in the Marshall Islands. *A.R.B.* No. 11:1-36.

Categories of land and land and marine resource ownership. Map, bibliography, lineage chart, glossary.

Topp, J. M. W.

1988. An Annotated Check List of the Flora of Diego Garcia, British Indian Ocean Territory. *A.R.B.* No. 313:1-19.

Description of Diego Garcia with check list of plants. Maps.

Townsend, C. C.

1971. List of Diego Garcia Bryophyta. *In* Stoddart and Taylor (editors) Geography and Ecology of Diego Garcia Atoll, Chagos Archipelago. *A.R.B.* No. 149:161-162.

List of mosses collected on Diego Garcia. Bibliography.

1975. Bryophytes from the Cook Islands. *In* Stoddart and Gibbs (editors) Almost-Atoll of Aitutaki: Reef Studies in the Cook Islands, South Pacific. *A.R.B.* No. 190:85-86.

List of the four bryophytes from the Cook Islands collected by Stoddart.

Townsend, M. M.

1961. Problems of Land Tenure on Malaita. *In* Doran (editor) Land Tenure in the Pacific. *A.R.B.* No. 85:27-32.

Social, economic and political aspects of land tenure on Malaita. Discussion of individualization of ownership.

Tracey, J. I.

1951. Geologic Studies of Coral Atolls. *A.R.B.* No. 1:9-10.

Recommendations for geologic research on coral atolls.

Tracey, J. I., P. E. Cloud and K. O. Emery

1955. Conspicuous Features of Organic Reefs. *A.R.B.* No. 46:1-3.

Definitions of component parts of reefs. Diagrams.

Trudgill, Stephen T.

1981. Geochemistry and Mineralogy of Carbonate Rock Samples from Aldabra Atoll, Indian Ocean. *A.R.B.* No. 255:11-22.

Analysis of rock samples from Aldabra with X-ray, fluorescence spectrometry, and carbonate staining. Table, map, and bibliography.

Tsuda, Roy T.

1964. Floristic Report on the Marine Benthic Algae of Selected Islands in the Gilbert Group. *A.R.B.* No. 105:1-13.

Study of marine benthic algae from Abemama, Marakei, Nonouti, Nukunau, Tamana, and Tarawa with goal of identifying sources of fish toxicity. Annotated list of blue- green, green, brown, and red algae from those islands. Bibliography.

1965. Marine Algae from Laysan Island with Additional Notes on the Vascular Flora. *A.R.B.* No. 110:1-31.

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Wilson, B. R.

1985. Notes on a Brief Visit to Seringapatam Atoll, North West Shelf, Australia. *A.R.B.* No. 292:83-100.

Observations on the structure of the reef near Seringapatam Atoll and the marine fauna associated with the reef. Photographs, species lists, diagrams, bibliography.

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Geology, soils, vegetation, and list of vascular plants and vertebrate terrestrial fauna from Marie-Louise Island in the Amirantes. Bibliography and map.

1983. Ecology of Desnoeufs, Amirantes Islands. *In* Sachet, Stoddart, and Fosberg (editors) Floristics and Ecology of Western Indian Ocean Islands. *A.R.B.* No. 273:203-222.

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Description of three types of mangrove sediments on Little Cayman. Diagrams.

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General description of Nui Atoll, Tuvalu. Description of vegetation zones and systematic list of vascular plants sighted with reference to voucher specimens. Maps, photographs and bibliography.

Woodward, Paul W.

1972. The Natural History of Kure Atoll, Northwestern Hawaiian Islands. *A.R.B.* No. 164:1-317.

General description of Kure Atoll with emphasis on avifauna and nesting habits. Maps, charts, bibliography.

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1979. Systematics and Ecology of the Land Crabs (Decapoda: Coenobitidae, Grapsidae and Gecarcinidae) of the Tokelau Islands, Central Pacific. *A.R.B.* No. 235:1-53.

Description of Tokelau Islands: climate, people, soils, vegetation, and fauna. Summary of systematics of land crabs noted in Tokelaus. Native names. Notes on land crab ecology. Tables, figures, photographs, maps and bibliography.

Zimmerman, E. C.

1951. Notes on Needs for Entomological Research on Coral Atolls. *A.R.B.* No. 1:18.

Very short statement concerning lack of knowledge of insects on coral atolls.

Zug, George R., Victor G. Springer, Jeffrey Williams and G. David Johnson

1988. The Vertebrates of Rotuma and Surrounding Waters. *A.R.B.* No. 316:1-25.

Description of vertebrate fauna of Rotuma with remarks on habitats. Fish fauna has zoogeographic affinity with Pacific plate fish while reptile fauna has affinity with Fijian reptiles. Species lists and bibliography.

INDEX BY LOCATION AND TOPIC

HOW TO USE THE INDEX BY LOCATION AND TOPIC

The following index is designed for researchers interested in geographic regions or specific islands. References are sorted primarily by the general area of the world, usually names of Oceans or Seas (e.g. Pacific or Mediterranean) or major near-by land masses (e.g. Australia and Central America). There are seven broad geographic regions designated: Australia, Caribbean, Central America, Indian Ocean, Malesia (the islands off Southeast Asia), Mediterranean, and Pacific.

Within each of these names of island groups and remote islands that lie outside any clear island group. Following the names of island groups are sometimes names of specific islands within those island groups. Some island groups are found in more than one general region. The cays off of Belize, for instance, are found both under Caribbean and Central America.

To look for any desired island, first find the general regional heading, then find its major island group or archipelago and then look to see if the particular island is listed. A few islands are listed separately if they are far from any well-known group. Such islands as Johnston Atoll, Clipperton, Cocos (Keeling), and Analega are listed without any inclusive island group or archipelago.

Such a hierarchical organization should make searches easier for people interested in a large region; all islands in an island group can be found close together in the index. There were many cases in which articles could not be neatly plugged into perfectly exclusive sets of geographic areas. Examples are articles on "Atolls of the Southwestern Caribbean", Islands of the "Western Pacific", and islands of the "Central Western Indian Ocean". These were placed both under the main headings, "Caribbean (in general)", "Pacific (in general)", and "Indian Ocean (in general)", respectively, as well as under the names given by the authors.

As a rule, geographic terms were used instead of political terms. For example, articles on Tarawa were indexed under Gilbert Islands rather than Kiribati and articles on Cosmoledo were indexed under Aldabra Group instead of Seychelles. I considered this policy more appropriate to research that is primarily biogeographic in nature since there is usually more specificity in archipelagos and island groups than in political units.

The solution to problem of changing place name spellings and new names vs old names for the same place was a matter of judgment in each individual case. In general, the current convention was used but older, still commonly-used names were usually given with a "see..." to guide the researcher. Thus someone looking for information on the Austral Islands will be rerouted to the "Tubuai Islands". In many cases, though, it was just as easy simply to duplicate listings under several place names

References listed under each place name are organized very generally according to subject matter. There is no consistency to these subject headings in the index. Instead they are meant only to give researchers a general idea of the scope of an article so that they can set priorities in their subsequent use of the contents list. Where there are dozens of references under a place name heading, a reference may be listed more than once if it covers several general topics.

References are composed simply of an abbreviated author name followed by the number and pages in the *Atoll Research Bulletin*. This gives just enough information to make the reference perfectly unique without taking up too much space. These references are even informative in and of themselves. From them researchers know who wrote an article, its length, and, roughly when it was written (knowing that it began in 1951 with number 1 and that this issue is number 347).

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HOW TO USE THE INDEX BY GEOLOGIC FEATURE AND TOPIC

Because many of the articles in the ARB concerned global problems on atolls, coral reefs, or other land and marine formations, there needs to be a separate index for these papers. Researchers particularly interested in categories of islands or in topics associated with general ocean or land forms might begin to look here.

The main headings in this index are geologic features. There are 10: Almost-Atolls; Islands (in general); Islands, tropical; Islands, Volcanic and other High Islands; Lagoons; Makatea; Reefs; and Tropics (in general). These are not at all mutually exclusive classes, but are terms used by authors and are better designators than terms arbitrarily ascribed to articles.

Under each of these ten major headings, the references are grouped according to topic. Terms used to describe the general topic are not perfectly consistent from reference across the index, but are intended to help the researcher sort through large numbers of references to set priorities in the use of the contents list.

References are composed simply of an abbreviated author name followed by the number and pages in the *Atoll Research Bulletin*. This gives just enough information to make the reference perfectly unique without taking up too much space. These references are even informative in and of themselves. From them researchers know who wrote an article, its length, and, roughly when it was written (knowing that it began in 1951 with number 1 and that this issue is number 347).

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INDEX BY TOPIC AND LOCATION/GEOLOGIC FEATURE

HOW TO USE THE INDEX BY TOPIC AND LOCATION/GEOLOGIC FEATURE

This index is meant for researchers whose primary interest is the topic of articles and who are secondarily interested in the geographic location. Like the index by location and topic, these headings are hierarchical.

There are 14 different main headings: Anthropology, Bibliography, Botany, Climate, Ecology, Economics, Geography, Geology, Health, History, Microbiology, Research, Research Methods, and Zoology. Because articles don't neatly fall within these categories, because many articles deal with several subjects, and because researchers may look under various headings for their interests, I did extensive cross-listing in this index.

Under each main heading there are more specific subheadings. As an example, "Fisheries" and "Phosphate Mining" fall under "Economics", and "Land Tenure" and "Material Culture" are found under "Anthropology".

For the two headings "Botany" and "Zoology", the systematic classification presents a readily applicable hierarchical indexing device. There is a crude adherence to this system, except where certain taxa are so frequently searched that a more prominent index position was in order. Thus I indexed *Acanthaster planci* independently from the other echinoderms and listed insects and crustaceans apart from the rest of the arthropods. Except for the algae and fungi, plants are not listed in any further hierarchical system. As a rule, articles that pertained to one taxon only (for example "Hemiptera", "*Acropora*", or "*Casuarina equisetifolia*") were indexed under those particular names, while lengthy lists of insects, coral species and plants that include these taxa were not.

Within each subheading, the references are sorted according to the geographic region or geologic feature to which they apply.

References are composed simply of an abbreviated author name followed by the number and pages in the *Atoll Research Bulletin*. This gives just enough information to make the reference perfectly unique without taking up too much space. These references are even informative in and of themselves. From them researchers know who wrote an article, its length, and, roughly when it was written (knowing that it began in 1951 with number 1 and that this issue is number 347).

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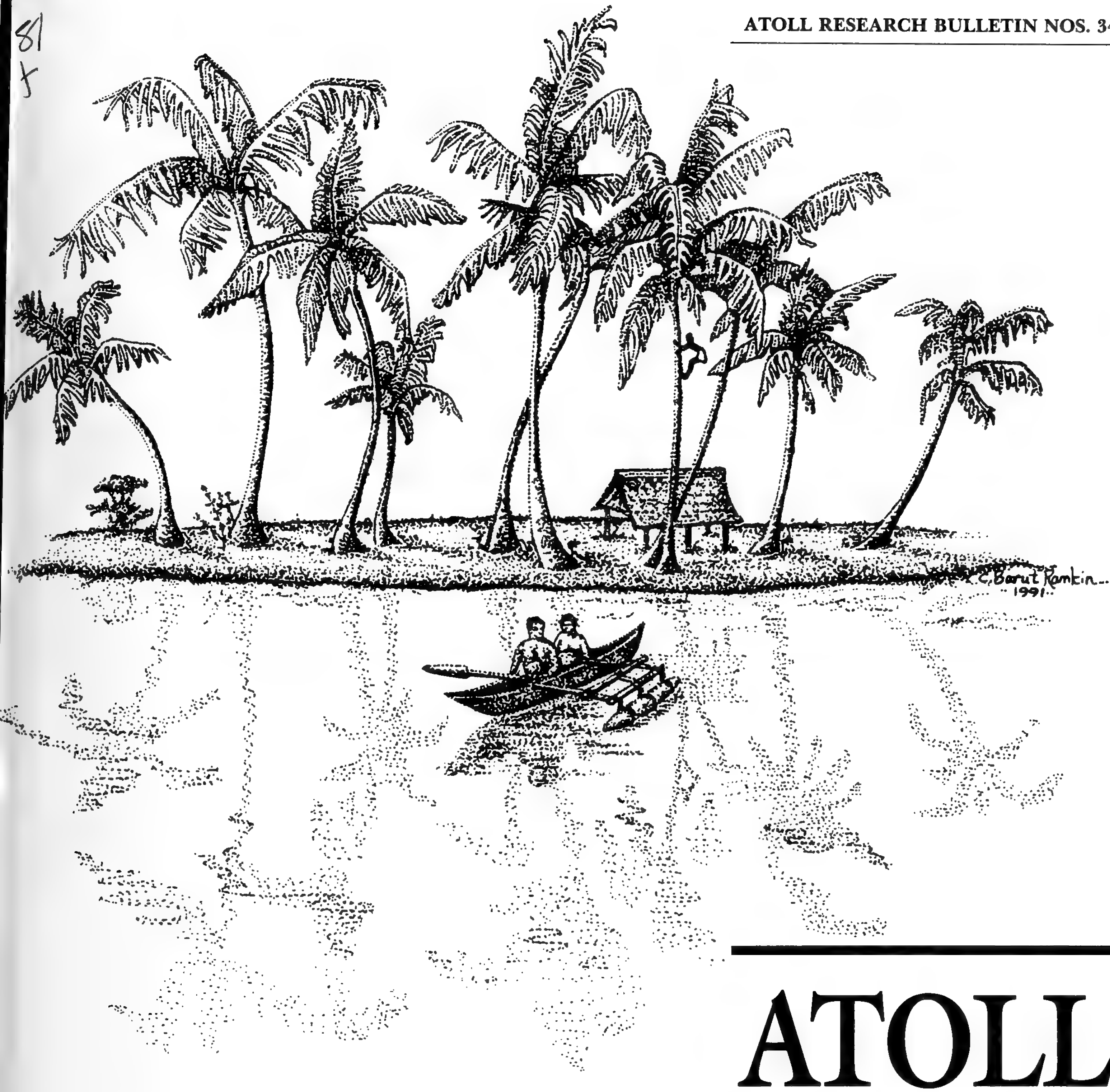

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Articles submitted for publication in the Atoll Research Bulletin should be original papers in a format similar to that found in recent issues of the Bulletin. First drafts of manuscripts should be typewritten double spaced. After the manuscript has been reviewed and accepted, the author will be provided with a page format with which to prepare a single-spaced camera-ready copy of the manuscript.

EDITORS

F. Raymond Fosberg Mark M. Littler Ian G.Macintyre Joshua I. Tracey, Jr.	National Museum of Natural History Smithsonian Institution Washington, D. C. 20560
David R. Stoddart	Department of Geography University of California Berkeley, CA 94720
Bernard Salvat	Laboratoire de Biologie & Ecologie Tropicale et Méditerranéenne Ecole Pratique des Hautes Etudes Labo. Biologie Marine et Malacologie Université de Perpignan 66025 Perpignan Cedex, France

BUSINESS MANAGER

Royce L. Oliver	National Museum of Natural History Smithsonian Institution Washington, D.C. 20560

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PLANTS OF THE REEF ISLANDS OF THE NORTHERN GREAT BARRIER REEF

BY

F. RAYMOND FOSBERG AND DAVID R. STODDART

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F. RAYMOND FOSBERG[1] AND DAVID R. STODDART[2]

Abstract

This paper records more than 380 species of vascular plants in 86 families from some 80 islands of the Great Barrier Reef north of 16°57'S. The list increases by an order of magnitude the generally perceived species diversity of the coral islands of the Great Barrier Reef.

Introduction

This paper lists the plants of the coral islands of the Great Barrier Reef north of Sudbury Cay (Latitude 16°57'S.); it extends to Arden Island, Dove Island and Masig (Yorke) Island in Latitude 9°45'S. It is based primarily on large collections made by Stoddart (1107 numbers, generally each in five sets) from 40 islands or island-groups, and sight records from a further 19 island-groups, obtained during detailed mapping of reef islands between 16°57'S (Sudbury Cay) and 11°36'S (Raine Island).

These collections have been augmented by the collections made subsequently by R. Buckley and H. Heatwole, deposited in the Queensland Herbarium, and made available to us by that institution.

We have attempted to include, so far as possible, previous literature records (dating back to collections by Sir Joseph Banks on Cook's first expedition in *Endeavour*), together with specimens we have found in various herbaria. Unfortunately we have been unable to trace (with few exceptions) the collections made by G. Tandy, botanist on the Great Barrier Reef Expedition 1928-29, on at least Low Isles and Three Isles. Tandy published no account of his work, and his material was incorporated in the general herbarium of the British Museum (Natural History), apparently without a separate list being kept. We think it unlikely, however, that he collected taxa unrecorded here. Particularly important are the records made by T. A. Walker of the Department of Environment and Conservation, Townsville, Queensland (Walker 1991, personal communications). We have included these in this paper though we have not seen his specimens. The phytogeography and vegetation of the northern Great Barrier Reef islands are discussed by Stoddart and Fosberg (1991).

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[1]Department of Botany, National Museum of Natural History, Smithsonian Institution, Washington, D.C.

[2]Department of Geography, University of California, Berkeley, CA.

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This list records more than 380 species in 86 families from some 80 islands. It dramatically revises previous understandings of the flora of the islands of the Great Barrier Reef. These were based on many collections from the southernmost islands (of the Bunker and Capricorn Groups), especially Heron Island, which continue to be among the best studied. Hill (1970, 76; 1974, 725) commented that

> the terrestrial flora of the cays [of the Great Barrier Reef] is a very restricted one, of only 30 to 40 species, practically all of which are of wide distribution in the Indo-West Pacific province.

This paper thus increases the recognized flora of the cays of the Great Barrier Reef by an order of magnitude, and it shows too that the flora is characterized by plants found on no other coral islands in the world. The flora of the southern islands is now better known, but is no more than 80 species. The biogeography of these distributions is discussed by Stoddart and Fosberg (1990).

Specimens are deposited in the National Museum of Natural History, Washington, DC, the Queensland Herbarium, Brisbane, and other herbaria.

We have referenced species in this list to the general account of the flora of the Great Barrier Reef (especially illustrations) by Cribb and Cribb (1985). We do not, however, accept all of their nomenclature.

We dedicate this paper to the memory of Sir Maurice Yonge and Professor Alfred Steers, whose innovative and original work in 1928-29 began the modern scientific study of the Great Barrier Reef.

ACANTHACEAE

Justicia procumbens L.

Raine Island: Stoddart 5058

Pseuderanthemum variabile (R. Br.) Radlk.

Fife Island: Heatwole, s.n.

AGAVACEAE

Agave sp. (probably *A. rigida* var. *sisalana* (Perrine) Engelm.)

Morris Island: Stoddart 4989

Dracaena angustifolia Roxb.

Dalrymple Island: Walker, s.n.; East Hope Island: Stoddart 4437; Masig Island: Walker (1991) [as *Pleomele angustifolia*]; Nymph Island: Stoddart, sight; West Cairncross Island: Heatwole, s.n., Walker (1991) [as *Pleomele angustifolia*]

Dracaena fragrans Ker-Gawl.

Green Island: Stoddart 4272

Sansevieria hyacinthoides (L.) Druce
Sansevieria trifasciata sensu auct. non Prain

Green Island: Fosberg 61503, Stoddart 4269

AIZOACEAE

Sesuvium portulacastrum (L.) L. Cribb and Cribb 1985, 75

Beanley Island: Stoddart, sight; Beesley Island: Stoddart, sight; Bewick Island: Stoddart 4156; Bramble Cay: Limpus et al (1983); Chapman Island: Heatwole, s.n., Stoddart 5040; Coombe Island: Stoddart 4031; Coquet Island: Walker, sight; Douglas Island: Walker (1991); Dove Island: Walker (1991); Eagle Island: Heatwole, s.n.; East Cairncross Island: Heatwole, s.n., Stoddart 4813; East Hannibal Island: Walker (1991); East Hope Island: Stoddart 4429; East Pethebridge Island: Stoddart 4471; Farmer Cay: Walker, sight; Fife Island: Heatwole, s.n., Stoddart 4948, Chaloupka and Godwin (1985); Fisher Island: Stoddart 5098; Green Island: Smith, Specht and Clapham (1973), Stoddart 4258; Hannah Island: Heatwole, s.n.; Hannibal Island: Heatwole,

s.n., Walker, sight; Houghton Island: Stoddart, sight; Howick Island: Mueller in Bailey, Fl. Qd. ['Howick Group'], Heatwole, s.n.; Ingram Island: Buckley 3740, Stoddart 4042; Kay Island: Stoddart 5095; Leggatt Island: Stoddart, sight; Low Isles: Stephenson et al. (1931), Stoddart 4314; Low Wooded Island: Stoddart 4567; Lowrie Island: Stoddart 4996; Magra Island: Stoddart, sight, King (1989); Michaelmas Cay: Stoddart 4214; Masig Island: Walker (1991); Morris Island: Stoddart 4985; Newton Island: Stoddart 4155; Nymph Island: Steers (1937, p. 8), Stoddart, sight, Heatwole 122; Pelican Island: Stoddart 4919; Pipon Island: Heatwole, s.n., Stoddart 4886, King (1986); Sand Island: Stoddart 4209; Saunders Island: Stoddart 5087, King and Limpus (1989); Sherrard Island: Stoddart 5029 (specimens lost); Sinclair Island: Stoddart 4196; Stainer Island: Chaloupka and Godwin (1985); Stapleton Island: Stoddart 4002; Sudbury Cay: Steers (1929), Stoddart 4220; Three Isles: Stephenson et al. (1931), Heatwole, s.n., Stoddart 4503; Turtle I Island: Stoddart 4827; Turtle II Island: Steers (1937), Stoddart, sight; Turtle III Island: Buckley 3558, Stoddart 4734; Turtle IV Island: Stoddart, sight; Turtle V Island: Stoddart, sight; Two Isles: Stoddart 4615; Upolu Cay: Stoddart 4219; Watson Island: Stoddart 4117, 4118; West Cairncross Island: Heatwole, s.n., Walker (1991); West Hannibal Island: Walker (1991); West Hope Island: Stoddart 4392, Walker (1991); West Pethebridge Island: Stoddart 4776; Wharton Island: Heatwole, s.n., Walker, sight.

Sesuvium sp.

Turtle II Island: Buckley 3365, 3431; Turtle VI Island: Buckley 3500.

AMARANTHACEAE

Achyranthes aspera L. — Cribb and Cribb 1985, 77-78

Arden Island: Walker (1991); Bramble Cay: Parmeter, s.n., Walker, s.n.; Binstead Island: Stoddart 5008 (collection lost); Bird Island: Heatwole 33; Chapman Island: Heatwole, s.n., Stoddart, sight; Coombe Island: Stoddart 4035; Coquet Island: Walker, sight; Douglas Island: Walker (1991); Dove Island: Walker (1991); Eagle Island: Heatwole, s.n., Stoddart 4807, Smith and Buckley (1986); East Cairncross Island: Heatwole, s.n.; East Hannibal Island: Walker (1991); Farmer Cay: Walker, sight; Fife Island: Heatwole, s.n., Stoddart 4938 (collection lost); Hannibal Island: Heatwole, s.n., Walker, sight; Ingram Island: Stoddart 4083; Low Isles: Stephenson et al. (1931), Stoddart 4327; Low Wooded Island: Stoddart 4852; Masig Island: Walker (1991); Newton Island: Stoddart 4147b; Pelican Island: Stoddart 4929; Raine Island: Stoddart 5053, Hacker (1990); Saunders Island: Stoddart 5067, King and Limpus (1989); Sinclair Island: Stoddart 4182; Stainer Island: Stoddart 4910, Chaloupka and Godwin (1985); Stapleton Island: Stoddart 4004; Turtle I Island: Stoddart 4714; Turtle III Island: Stoddart 4751; Turtle V Island: Buckley 3389; Wallace Island: King et al. (1989b), Walker (1991); West Cairncross Island: Heatwole, s.n., Walker (1991); West Hannibal Island: Walker (1991); West Hope Island: Stoddart 4390, Walker (1991); Wharton Island: Heatwole, s.n., Walker, sight.

Amaranthus interruptus R. Br.

Raine Island: Stoddart 5057; Three Isles: Heatwole, s.n.; Turtle II Island: Buckley 3046(?).

Amaranthus viridis L.

Arden Island: Walker (1991); Bird Island: Heatwole 28; Dove Island: Walker (1991); Masig Island: Walker (1991); Raine Island: Hacker (1990).

AMARYLLIDACEAE

Crinum pedunculatum

Masig Island: Walker (1991); West Hope Island: Walker (1991).

Crinum sp.

Low Wooded Island: Stoddart 4583; Pipon Island: Heatwole, s.n.

Eurycles amboinensis Loud.

Cairncross Island: Veitch in Bailey, Fl. Qd., p. 1612 ['Islands of Cairncross']; Dove Island: Walker (1991) [as *Proiphys amboinensis*]; Masig Island: Walker (1991) [as *Proiphys amboinensis*]; West Cairncross Island: Heatwole, s.n., Walker (1991) [as *Proiphys amboinensis*].

ANACARDIACEAE

Euroschinus falcatus Hook. f.

Green Island: Gardner (1973).

ANNONACEAE

Cananga odorata Hook. f.

West Cairncross Island: Heatwole, s.n., Walker (1991).

Polyalthia nitidissima Benth.

Green Island: Smith, Specht and Clapham (1973).

APOCYNACEAE

Alstonia scholaris (L.) R. Br.

Green Island: Specht list.

Alyxia spicata R. Br. Cribb and Cribb 1985, 81

Green Island: Specht list.

Carissa laxiflora Benth.

Hannibal Island: Heatwole, s.n. (possibly); Turtle I Island: Buckley 3598; West Cairncross Island: Heatwole, s.n. (possibly), Walker (1991) [as *Carissa laxifolia*]; West Hannibal Island: Walker (1991) [as *Carissa laxifolia*].

Carissa sp.

Arden Island: Walker (1991).

Catharanthus roseus (L.) G. Don Cribb and Cribb 1985, 81-82

Dalrymple Island: Walker, s.n.; Low Isles: Stoddart 4347, Heatwole, s.n.; Masig Island: Walker (1991).

Cerbera manghas L. Cribb and Cribb 1985, 82-83, 254

Green Island: Smith, Specht and Clapham (1973), Stoddart 4287.

Nerium oleander L.

Pipon Island: Heatwole, s.n., Stoddart 4889, King (1986).

ARACEAE

Philodendron lacerum (Jacq.) Schott

Green Island: Stoddart 4259.

Philodendron sp.

Green Island: Specht list.

Typhonium roxburghii Schott

Turtle I Island: Buckley 3592.

Typhonium sp.

Turtle II Island: Buckley 3422.

ARALIACEAE

Polyscias balfouriana L. H. Bailey

Low Isles: Stoddart 4361.

Polyscias guilfoylei (Bull) L. H. Bailey

Low Isles: Fosberg 55053, Stoddart 4362, Heatwole, s.n.

Polyscias paniculata Baker

Low Isles: Heatwole, s.n.

Polyscias tricochleata (Miq.) Fosberg

Low Isles: Fosberg 55051.

Schefflera actinophylla (Endl.) Harms. Cribb and Cribb 1985, 85
Brassaia actinophylla Endl.

Green Island: Cairns City Council (1933) [as *Brassaia actinophylla*]; Low Isles: Stoddart 4359; Low Wooded Island: Stoddart 4540; West Hope Island: Walker (1991).

Schefflera sp.

Milman Island: Buckley 3901.

ARECACEAE (PALMAE)

Archontophoenix alexandrae (F.v.M.) Wendl. & Drude

Green Island: Specht list.

Arenga australasica (Wendl. & Drude) S. T. Blake   Cribb and Cribb 1985, 88

Green Island: Smith, Specht and Clapham (1973), Stoddart 4262.

Calamus australis Mart.

Green Island: Specht list.

Calamus muelleri Wendl. & Drude

Green Island: Cairns City Council (1933) [as *Camulus mullerii*].

Cocos nucifera L.   Cribb and Cribb 1985, 88-89, 256

Arden Island, Walker (1991); Bramble Cay: Walker, sight (dead); Dalrymple Island: Walker, s.n.; Dove Island: Walker (1991); Fife Island: Chaloupka and Godwin (1985); Green Island: Cairns City Council (1933) [as *Cocos australis*], Smith, Specht and Clapham (1973), Stoddart, sight; Kay Island: Stoddart, sight (juvenile); Low Isles: Stephenson et al. (1931), Fosberg, sight, Stoddart, sight; Magra Island: Stoddart, sight (juveniles); Masig Island: Walker (1991); Morris Island: Stoddart, sight (one individual); Night Island: Steers (1937, p. 122, 1938, p. 92); Nymph Island: Stoddart, sight; Saunders Island: Stoddart, sight (one juvenile); Sudbury Cay: Stoddart, sight (two seedlings); Three Isles: Stephenson et al. (1931), Stoddart, sight; Turtle II Island: Stoddart, sight; Turtle IV Island: Stoddart, sight; Turtle V Island: Stoddart, sight; West Hannibal Island: Walker (1991); West Hope Island (Walker 1991).

Phoenix dactylifera L.

Low Isles: Fosberg, sight.

Phoenix sp.

Three Isles: Warham (1962, p. 100), sight.

Ptychosperma elegans (R. Br.) Bl.

Green Island: Cairns City Council (1933), Specht list; Low Isles: Heatwole, s.n. (probably); West Cairncross Island: Heatwole, s.n., Walker (1991).

ASCLEPIADACEAE

Calotropis procera (Ait.) Ait. f.

Dove Island: Walker (1991).

Cynanchum carnosum (R. Br.) Domin

West Hope Island: Walker (1991).

Hoya australis R. Br.

Two Isles: Stoddart 4622, 4652.

Ischnostemma carnosum Merr. & Rolfe

Baird III Island: Buckley 3832; Bushy Island: Buckley 5222, 5226; ; Chapman Island: Heatwole, s.n.; East Cairncross Island: Heatwole, s.n.; Hannah Island: Heatwole, s.n.; Hannibal Island: Heatwole, s.n.; Low Isles: Stoddart 4331; Lowrie Island: Buckley 5044; ; South Bird Island: Buckley 5165; Turtle I Island: Stoddart 4725; Turtle VI Island: Buckley 3481, 3490; West Hope Island: Stoddart 4459, 4460; West Pethebridge Island: Stoddart 4784.

Sarcostemma australe R. Br. Cribb and Cribb 1985, 91

Howick Island: Mueller in Bailey, Fl. Qd. [as 'Howick Group']; Ingram Island: Stoddart 4046; King Island: Walker, sight; Low Wooded Island: Stoddart 4581; Nymph Island: Heatwole 141; Turtle I Island: Buckley 3583, Stoddart 4692; Turtle III Island: Stoddart 4735.

ASTERACEAE

Bidens bipinnata L.

Turtle II Island: Buckley 3408, 3436, 3660; ; Turtle VI Island: Buckley 3494.

Bidens pilosa L. Cribb and Cribb 1985,92

Dove Island: Walker (1991); East Cairncross Island: Heatwole, s.n.; Farmer Cay: Walker, sight; Masig Island: Walker (1991); West Cairncross Island: Heatwole, s.n., Walker (1991) (?).

Emilia sonchifolia (L.) DC.

Nymph Island: Heatwole 138; Three Isles: Stoddart 4486; Turtle V Island: Buckley 3386; Two Isles: Stoddart 4650; West Cairncross Island: Walker (1991); West Hope Island: Walker (1991).

Glossogyne tannensis (Spreng.) Garnock-Jones
Glossogyne benuifolia (Labill.) Cass. ex Less.

Fife Island: Heatwole, s.n.; Howick Island: Heatwole, s.n.

Pterocaulon sphacelatum B & H.

Stapleton Island: Buckley 3757; Three Isles: Heatwole, s.n., Stoddart 4476.

Tridax procumbens Forst.

Dalrymple Island: Walker, s.n.; Dove Island: Walker (1991); East Hope Island: Stoddart 4378; Green Island: Smith, Specht and Clapham (1973), Stoddart 4223; Low Isles: Fosberg 55043, Heatwole, s.n., Stoddart 4306; Masig Island (Walker 1991); Turtle I Island: Buckley 3577, Stoddart 4667; Turtle III Island: Buckley 3556, Stoddart 4729; West Hope Island: Stoddart 4462.

Vernonia cinerea (L.) Less.

Nymph Island: Heatwole 138; Three Isles: Heatwole, s.n.

Wollastonia biflora (L.) DC. Cribb and Cribb 1985,92-93
Wedelia biflora (L.) DC.

Coombe Island: Stoddart 4017; Dove Island: Walker (1991); Eagle Island: Heatwole, s.n., Buckley 3444, Stoddart 4816; Fife Island: Stoddart 4941 (collection lost); Green Island: Mauritzon in 1936(S), Smith, Specht and Clapham (1973), Fosberg 61512, Stoddart 4231, Heatwole, s.n.; Howick Island: Heatwole, s.n., Stoddart 4848; Low Wooded Island: Stoddart 4551; Masig Island: Walker (1991); Morris Island: Stoddart 4970; Nymph Island: Stoddart , sight, Heatwole, s.n.; Pipon Island: Stoddart 4872, Heatwole, s.n.; Saunders Island: Stoddart 5064; Three Isles: Heatwole, s.n.; Stoddart 4496 (collection lost); Turtle V Island: Stoddart, sight; Two Isles: Stoddart 4601; West Cairncross Island: Walker (1991); West Hannibal Island: Walker (1991); West Hope Island: Stoddart 4393, Walker (1991).

AVICENNIACEAE

Avicennia eucalyptifolia Zipp. ex Miq. Cribb and Cribb 1985,236-237, 281

Howick Island: Moldenke (1971) [this may be the same as the following species].

Avicennia marina (Forssk.) Vierh. var. *alba* (Bl.) Balch.

Howick Island: Stoddart 4203.

Avicennia marina (Forssk.) Vierh. var. *australasica* (Walpers) Moldenke
Cribb and Cribb 1985, 236

Bewick Island: Thom [as Stoddart 4163]; Chapman Island: Stoddart 5038; East Pethebridge Island: Stoddart 4762, Heatwole, s.n.; Fife Island: Heatwole, s.n.; Fisher Island: Stoddart 5102; Hampton Island: Stoddart 4211; Hannibal Island: Heatwole, s.n.; Howick Island: Heatwole, s.n.; Ingram Island: Stoddart 4069; Lance Island: Buckley 3758a; Leggatt Island: Buckley 5015; Low Isles: Stephenson et al. (1931) [as *A. officinalis*], Stoddart 4336; Low Wooded Island: Stoddart 4524; Lowrie Island: Buckley 3796 [or var. *alba*], Stoddart 4998; Pipon Island: Heatwole, s.n., Stoddart 4869, King (1986); Sand Island: Stoddart 4210; Three Isles: Heatwole, s.n., Stoddart 4499; Turtle I Island: Stoddart 4697; Turtle II Island: Buckley 3432, 3663; Turtle III Island: Stoddart 4745; Turtle VI Island: Buckley 3503; Two Isles: Stoddart 4636; West Cairncross Island: Heatwole, s.n.; West Hope Island: Stoddart 4405; West Pethebridge Island: Stoddart 4774.

BATIDACEAE

Batis argillicola Van Royen

Binstead Island: Buckley 5055, 5056; Low Wooded Island: Stoddart 4566.

BIGNONIACEAE

Pandorea pandorana (Andr.) van Steenis

Howick Island: Heatwole, s.n.; West Cairncross Island: Heatwole, s.n., Walker (1991).

BORAGINACEAE (including EHRETIACEAE)

Cordia subcordata Lam. Cribb and Cribb 1985, 98-99

Aplin Island: Buckley 5254; Arden Island: Walker (1991); Bewick Island: Stoddart 4093; Binstead Island: Stoddart 5012 (collection lost); Bird Island: Stoddart 5091; Chapman Island: Stoddart 5041; Dalrymple Island: Walker, s.n.; Dove Island: Walker (1991); East Hope Island: MacGillivray in Bailey, Fl. Qd. [as 'Hope Island'], Stoddart 4377; Green Island: Cairns City Council (1933), St John (1967), Smith, Specht and Clapham (1973), Fosberg 61522; Hannibal Island: Heatwole, s.n.; Ingram Island: Stoddart 4040; Low Wooded Island: Stoddart 4545; Magra Island: Stoddart , sight; Masig Island: Walker (1991); Morris Island: Stoddart 4968; Newton Island: Stoddart 4159; Turtle I Island: Stoddart 4720; Turtle IV Island: Stoddart , sight; Two Isles: Stoddart 4627; Wallace Island: King et al. (1989b), Walker (1991); West Cairncross Island: Heatwole, s.n., Walker (1991); West Hannibal Island: Walker (1991); West Hope Island: Walker (1991).

Tournefortia argentea L. f. Cribb and Cribb 1985, 95-97
Argusia argentea (L. f.) L. F. Heine

Arden Island: Walker (1991); Dalrymple Island: Walker (1991); Dove Island: Walker, s.n.; Bird Island: Stoddart, sight; Coombe Island: Stoddart 4027; Eagle Island: MacGillivray (1852, I, p. 117) [as *Tournefortia*], Heatwole, s.n. Stoddart 4797, Smith and Buckley (1986) [as *Argusia argentea*]; East Cairncross Island: Heatwole, s.n.; Fife Island: Stoddart 4971; Green Island: Cairns City Council (1933), Fosberg 61520, Stoddart 4234; Houghton Island: Stoddart , sight; Howick Island: Mueller in Bailey, Fl. Qd., p. 1041 [as 'Howick's Group']; Ingram Island: Stoddart 4048; King Island: Walker, sight; Low Isles: Stephenson et al. (1931), Heatwole, s.n., Stoddart 4319, 4373; Low Wooded Island: Stoddart 4559; Magra Island: Stoddart, sight, King (1989) [as *Argusia argentea*]; Masig Island: Walker (1991); Nymph Island: Heatwole 145, Stoddart, sight; Saunders Island: Stoddart 5063, King and Limpus (1989) [as *Argusia* sp.]; Sherrard Island: Stoddart 5032 (collection lost); Three Isles: Heatwole, s.n., Stoddart 4468; Turtle III Island: Stoddart 4759; Turtle V Island: Stoddart, sight; Two Isles: Stoddart 4595; West Cairncross Island: Heatwole, s.n., Wallace (1991); West Hope Island: Stoddart 4409, Wallace (1990).

BRASSICACEAE (CRUCIFERAE)

Coronopus integrifolius (DC.) Spreng.

Bird Island: Denham in Bailey, Fl. Qd., p. 51 [as *Senebiera integrifolia* DC.]; Raine Island: Stoddart 5060.

BURSERACEAE

Canarium australianum F. v. M.

Binstead Island: Buckley 5057; Green Island: Smith, Specht and Clapham (1973); Leggatt Island: Buckley 3722a; Lowrie Island: Buckley 5047; Three Isles: Stoddart 4478.

Canarium vitiense A. Gray

Green Island: Specht list.

Garuga floribunda Decne.

Hannibal Island: Heatwole, s.n.; West Cairncross Island: Walker (1991); West Hannibal Island: Walker (1991).

CAPPARIDACEAE (including CLEOMACEAE)

Capparis arborea (F. Muell.) Maiden

Arden Island: Walker (1991).

Capparis lucida R. Br.

Aplin Island: Buckley 5255; Arden Island: Walker (1991); Baird Island: Buckley 5110; Baird III Island: Buckley 3835(?); Bewick Island: Stoddart, sight; Chapman Island: Heatwole, s.n., Buckley 5068, Stoddart 5037; Coombe Island: Stoddart 4028; Douglas Island: Buckley 5245 (sterile), 5247, Walker (1991); Dove Island: Walker (1991); Dugong Island: Buckley 5271, 5272, 5273, 5274, 5281, 5282, 5283, 5284; Eagle Island: Heatwole, s.n., Buckley 3467 (?) (sterile), Stoddart 4804; East Hope Island: Stoddart 4374, Bailey, Fl. Qd., p. 60 [as 'Hope Islands']; Farmer Island: Buckley 5093, 5096; Fife Island: Steers (1938), Heatwole, s.n., Chaloupka and Godwin (1985), Buckley 3783a; Hannah Island: Heatwole, s.n.; Hannibal Island: Heatwole, s.n.; Hay Island: Buckley 3771(?), 3773; Houghton Island: Stoddart, sight; Howick Island: Bailey, Fl. Qd., p. 60 [as 'Howick's Group'], Heatwole, s.n., Stoddart 4853; Low Wooded Island: Stoddart 4543, 4575; MacArthur Island: Buckley 5187(?) (sterile); Masig Island: Walker (1991); Newton Island: Stoddart 4135; Pipon Island: Heatwole, s.n., Stoddart 4873; Turtle I Island: Stoddart 4684; Turtle II Island: Buckley 3420, 3659; Turtle III Island: Stoddart 4758, Buckley 3559 (collection missing); Turtle V Island: Buckley 3524, 3533; Turtle VI Island: Buckley 3515, Stoddart, sight; Two Isles: Stoddart 4607; Watson Island: Stoddart 4102; West Cairncross Island: Heatwole, s.n., Walker (1991); West Hannibal Island: Walker (1991); West Hope Island: Stoddart 4461, Walker (1991) (?); West Pethebridge Island: Stoddart 4780.

Capparis quiniflora DC.

Eagle Island: Heatwole, s.n.; East Cairncross Island: Heatwole, s.n.; West Cairncross Island: Heatwole, s.n., Walker (1991).

Capparis sarmentosa A. Cunn. ex Benth.

Chapman Island: Buckley 5067(?) (sterile); Douglas Island: Buckley 5241(?) (sterile), Walker (1991).

Capparis sepiaria L.

Binstead Island: Buckley 5061; Bushy Island: Buckley 5239; Dugong Island: Buckley 5278, 5280; East Hope Island: Stoddart 4449; Farmer Island: Buckley 5095; Fife Island: Buckley 5028, Chaloupka and Godwin (1985); MacArthur Island: Buckley 5185; Pelican Island: Stoddart 4923; West Hope Island: Walker (1991).

Capparis spinosa var. *nummularia* (DC.) F. M. Bailey

Arden Island: Walker (1991); Bird Island: Buckley 3926; Dove Island: Walker (1991); Farmer Island: Buckley 3823(?); Howick Island: Heatwole, s.n., Stoddart 4847; Ingram Island: Buckley 3726, Stoddart 4074; Sinclair Island: Buckley 3703, 5001, Stoddart 4188; Three Isles: Stoddart 4501; Two Isles: Stoddart 4642; Watson Island: Stoddart 4101.

Capparis sp.

Douglas Island: Buckley 3887; Farmer Island: MacGillivray (1852, I, p. 117); Masig Island: Walker (1991); Turtle III Island: Buckley 3562; Turtle V Island: Buckley 3535, 3546, 3547; West Cairncross Island: Walker (1991).

Cleome viscosa L.

Coombe Island: Stoddart 4036; Douglas Island: Walker (1991); Dove Island: Walker (1991); East Hannibal Island: Walker (1991); Fife Island: Steers (1938) [as *Polanisia viscosa*], Heatwole, s.n., Stoddart 4953, Chaloupka and Godwin (1985); Hannah Island: Heatwole, s.n.; Hannibal Island: Heatwole, s.n.; Howick Island: Heatwole, s.n.; Ingram Island: Stoddart 4065; Masig Island: Walker (1991); Morris Island: Stoddart 4980; Newton Island: Stoddart 4136; Pelican Island: Stoddart 4930 (collection lost); Pipon Island: Heatwole, s.n., Stoddart 4897; Raine Island: Hacker (1990); Saunders Island: Stoddart 5085; Sherrard Island: Stoddart 5025 (collection lost); Sinclair Island: Stoddart 4181; Stainer Island: Chaloupka and Godwin (1985); Three Isles: Heatwole, s.n.; Turtle I Island: Stoddart 4668; Turtle II Island: Buckley 3364, 3403, 3410, 3411; Turtle III Island: Stoddart 4737; Turtle V Island: Buckley 3387, 3538(?); Turtle VI Island: Buckley 3479; Watson Island: Stoddart 4122; West Cairncross Island: Walker (1991); West Hannibal Island: Walker (1991).

CARICACEAE

Carica papaya L.

Green Island: Stoddart 4260.

CASUARINACEAE

Casuarina equisetifolia L. var. *incana* Benth. Cribb and Cribb 1985, 105-108, 260

Arden Island: Walker (1991); Bewick Island: Stoddart 4099; Coquet Island: Stoddart, sight; Dalrymple Island: Walker, s.n.; Eagle Island: Heatwole, s.n., Stoddart 4803; Green Island: Cairns City Council (1932) [as *Casuarina cunninghamiana*], Smith, Specht and Clapham (1973), Fosberg 61517, Stoddart 4246; Hannibal Island: Heatwole, s.n., Walker, sight; Houghton Island: Stoddart, sight; Howick Island: Heatwole, s.n.; Ingram Island: Stoddart 4057; King Island: Walker, sight; Leggatt Island: Stoddart, sight; Low Isles:

Stephenson et al. (1931), Fosberg 55039, Heatwole, s.n., Stoddart 4342; Low Wooded Island: Stoddart 4578; Masig Island: Walker (1991); Newton Island: Stoddart 4140; Nymph Island: Heatwole 149, Stoddart, sight; Saunders Island: Stoddart 5080, King and Limpus (1989); Stainer Island: Chaloupka and Godwin (1985); Three Isles: Stephenson et al. (1931), Heatwole, s.n., Stoddart 4487; Turtle I Island: Stoddart 4727; Turtle III Island: Stoddart 4742; Turtle V Island: Stoddart, sight; Two Isles: Stoddart 4618; West Cairncross Island: Heatwole, s.n., Walker (1991); West Hannibal Island: Walker (1991).

CELASTRACEAE

Elaeodendron australe Vent.

Low Wooded Island: Stoddart 4543.;

Elaeodendron melanocarpum F. v. M.

East Cairncross Island: Heatwole, s.n.; Green Island: Smith, Specht and Clapham (1973); Nymph Island: Heatwole 148.

Maytenus emarginata (Willd.) Ding Hou

Dalrymple Island: Walker, s.n.; Turtle II Island: Buckley 3377; Turtle VI Island: Buckley 3495.

Salacia chinensis L.

Dove Island: Walker (1991).

CHENOPODIACEAE

Arthrocnemum halocnemoides Nees (sensu lato)
Halosarcia halocnemoides (Nees) P. G. Wilson

East Cairncross Island: Heatwole, s.n.; Hannibal Island: Heatwole, s.n. [var. *pergranulatum*]; Nymph Island: Heatwole 133; Watson Island: Stoddart 4111; West Hope Island: Walker (1991) [as *Halosarcia halocnemoides*]; Wharton Island: Heatwole, s.n.

Arthrocnemum leiostachyum (Benth.) Paulsen

Nymph Island: Heatwole, s.n.; Two Isles: Stoddart 4632.

Salicornia cinerea F.v.M.

Nymph Island: Heatwole 119 [is this previous species?].

Salicornia quinqueflora Bunge ex Ungern Sternberg — Cribb and Cribb 1985, 110

Bewick Island: Stoddart 4157; East Pethebridge Island: Stoddart 4772; Fisher Island: Stoddart 5107; Low Isles: MacGillivray (1852), I, p. 101) [as *Salicornia indica*]; Low Wooded Island: Stoddart 4568; Nymph Island: Stoddart, sight; Pipon Island: Stoddart 4904; Three Isles: Stoddart 4515; Turtle I Island: Stoddart 4828; Turtle II Island: Stoddart, sight; Turtle III Island: Stoddart 4744; Turtle V Island: Stoddart, sight; Turtle VI Island: Stoddart, sight; Two Isles: Stoddart 4644.

Salsola kali L. — Cribb and Cribb 1985, 109

Arden Island: Walker (1991); Coombe Island: Stoddart 4022; Dalrymple Island: Walker, s.n.; Douglas Island: Walker (1991); Dove Island: Walker (1991); Eagle Island: Heatwole, s.n., Stoddart 4812; East Cairncross Island: Heatwole, s.n.; East Hope Island: Stoddart 4428; Fife Island: Stoddart 4946 (collection lost), Chaloupka and Godwin (1985); Hannibal Island: Heatwole, s.n.; Howick Island: Heatwole, s.n.; Ingram Island: Stoddart 4072; Low Wooded Island: Stoddart 4573; Masig Island: Walker (1991); Newton Island: Stoddart 4150; Nymph Island: Heatwole 147; Pelican Island: Heatwole, s.n., Stoddart 4934; Pipon Island: Heatwole, s.n., Stoddart 4892; Saunders Island: Stoddart 5072; Sinclair Island: Stoddart 4184; Stainer Island: Stoddart 4912, Chaloupka and Godwin (1985); Stapleton Island: Stoddart 4010; Three Isles: Heatwole, s.n., Stoddart 4502; Two Isles: Stoddart 4594; Wallace Island: King et al. (1989b), Walker (1991); West Cairncross Island: Heatwole, s.n.; West Hannibal Island: Walker (1991); Wharton Island: Heatwole, s.n., Walker, sight.

Suaeda australis Moq. — Cribb and Cribb 1985, 110-111

Bewick Island: Stoddart 4158; Binstead Island: Buckley 3806; Chapman Island: Heatwole, s.n., Stoddart 5046; East Hannibal Island: Walker (1991); Hannibal Island: Heatwole, s.n.; Low Isles: Stoddart 4313; Low Wooded Island: Stoddart 4569; Newton Island: Stoddart 4152; Pipon Island: Heatwole, s.n., Stoddart 4879; South Bird Island: Buckley 5163; Three Isles: Heatwole, s.n., Stoddart 4516; Turtle I Island: Stoddart 4829; Turtle III Island: Stoddart 4743; Two Isles: Stoddart 4643; Watson Island: Stoddart 4112; West Hope Island: Stoddart 4380, Walker (1991); West Pethebridge Island: Stoddart 4781; Wharton Island: Heatwole, s.n.

Suaeda sp.

Houghton Island: Stoddart, sight; Leggatt Island: Stoddart, sight; Nymph Island: Stoddart, sight; Turtle II Island: Buckley 3367, Stoddart, sight; Turtle IV Island: Stoddart, sight; Turtle V Island: Buckley 3550, Stoddart, sight; Turtle VI Island: Buckley 3517, Stoddart, sight.

COCHLOSPERMACEAE

Cochlospermum gillivraei Benth.

Masig Island: Walker (1991).

COMBRETACEAE

Lumnitzera racemosa Willd. Cribb and Cribb 1985, 217-218

Baird Island: Buckley 5112; Cairncross Island: MacGillivray and Henne in Bailey, Fl. Qd., p. 569; ; Chapman Island: Buckley 5066; Low Isles: Fosberg, sight; Lowrie Island: Buckley 3793, 5036; Pipon Island: Stoddart 4900; Turtle II Island: Buckley 3642b; Turtle IV Island: Buckley 3565; Turtle V Island: Buckley 3530; Turtle VI Island: Buckley 3506.

Terminalia arenicola Byrnes Cribb and Cribb 1985, 114

Aplin Island: Buckley 3903; Bushy Island: Buckley 5219; Green Island: Cairns City Council (1933), Smith, Specht and Clapham (1971); Leggatt Island: Buckley 5009; Little Boydong: Buckley 5196.

Terminalia catappa L. Cribb and Cribb 1985, 115, 263

Arden Island: Walker (1991); East Hope Island: Stoddart, sight; Green Island: Smith, Specht and Clapham (1973), Fosberg 61516, Stoddart 4286; Low Isles: Stephenson et al. (1931); West Hope Island: Walker (1991).

Terminalia melanocarpa F. v. M.

Aplin Island: Buckley 3903; Bushy Island: Buckley 5219; Green Island: Cairns City Council (1933), Smith, Specht and Clapham (1973); Howick Island: Heatwole, s.n.; Leggatt Island: Buckley 5009; Little Boydong: Buckley 5196; West Cairncross Island: Heatwole, s.n., Walker (1991).

Terminalia muelleri Benth.

Arden Island: Walker (1991); Bewick Island: Stoddart 4096; Eagle Island: Heatwole, s.n., Stoddart 4802; Howick Island: Mueller in Bailey, Fl. Qd., p. 567 [as 'Howick's Group']; Ingram Island: Stoddart 4049, 4052; Low Isles: Heatwole, s.n.; Low Wooded Island: Stoddart 4534; Three Isles: Stoddart 4489; Turtle III Island: Stoddart 4754; Turtle VI Island: Buckley 3496; Two Isles: Stoddart 4602.

Terminalia platyphylla F. v. M.

Little Boydong: Buckley 5200(?).

Terminalia sericocarpa F. v. M.

Green Island: Smith, Specht and Clapham (1973).

Terminalia sp.

Masig Island: Walker (1991); Turtle I Island: Buckley 3613; Turtle II Island: Buckley 3637; Wallace Island: Buckley 3869; West Cairncross Island: Walker (1991).

COMMELINACEAE

Commelina ensifolia R. Br.

Green Island: Smith, Specht and Clapham (1973).

Commelina lanceolata R. Br.

Arden Island: Walker (1991); Dove Island: Walker (1991).

Commelina undulata R. Br.

East Cairncross Island: Heatwole, s.n.; Green Island: Specht list; Low Isles: Fosberg 55033, Stoddart 4330; Low Wooded Island: Stoddart 4562; Nymph Island: Heatwole, s.n.; Sinclair Island: Stoddart 4177; Turtle I Island: Stoddart 4669; Turtle II Island: Buckley 3418; Turtle III Island: Buckley 3418; Watson Island: Stoddart 4121; West Cairncross Island: Heatwole, s.n., Walker (1991); West Hope Island: Walker (1991).

Commelina sp.

Douglas Island: Walker (1991); Masig Island: Walker (1991); Three Isles: Heatwole, s.n.; West Cairncross Island: Heatwole, s.n., Walker (1991).

CONVOLVULACEAE

Cuscuta australis R. Br.

Green Island: Cairns City Council (1933).

Ipomoea aquatica Forssk.

Arden Island: Walker (1991).

Ipomoea macrantha R. & S. Cribb and Cribb 1985, 116

Beesley Island: Stoddart, sight; Chapman Island: Heatwole, s.n. (possibly), Stoddart, sight; Dalrymple Island: Walker, s.n.; Douglas Island: Walker (1991) (?); Dugong Island: Buckley 5276a; Eagle Island: Stoddart 4830; East Cairncross Island: Heatwole, s.n.; East Hope Island: Stoddart 4379, 4419; Fife Island: Heatwole, s.n., Stoddart 4942 (collection lost), Chaloupka and Godwin (1985); Green Island: Cairns City Council (1933), Smith, Specht and Clapham (1973) [as *Ipomoea tuba*], Stoddart 4273; Hannibal Island: Heatwole, s.n.; Howick Island: Heatwole, s.n. (probably); Ingram Island: Stoddart 4077; Leggatt Island: Buckley 5016(?); Low Isles: Fosberg, sight, Stoddart 4340, 4341 (collections lost); Nymph Island: Heatwole, s.n.; Raine Island: Hacker (1990); Saunders Island: Stoddart 5076; Sherrard Island: Buckley 5065; Turtle I Island: Stoddart 4724; Turtle II Island: Buckley 3413, 3435; Turtle IV Island: Stoddart, sight; Two Isles: Stoddart 4605; Watson Island: Stoddart 4103; West Cairncross Island: Heatwole, s.n., Walker (1991); West Hannibal Island: Walker (1991); West Hope Island: Walker (1991); West Pethebridge Island: Stoddart 4783; Wharton Island: Heatwole, s.n., Walker, sight.

Ipomoea nil (L.) Roth

Buchan Island: Buckley 3839; Dove Island: Walker (1991); Fife Island: Chaloupka and Godwin (1985); Pelican Island: Buckley 3767; Stainer Island: Buckley 3761.

Ipomoea pes-caprae (L.) R. Br. ssp. *brasiliensis* (L.) v. Ooststr.
Cribb and Cribb 1985, 116-117

Arden Island: Walker (1991); Binstead Island: Stoddart 5004 (collection lost); Cholmondeley Island: King et al. (1989a); Coombe Island: Stoddart 4037; Dalrymple Island: Walker, s.n.; Douglas Island: Walker (1991); Dove Island: Walker (1991); Eagle Island: Stoddart 4824; East Cairncross Island: Heatwole, s.n.; East Hope Island: Stoddart 4375; Farmer Cay: Walker, sight; Fife Island: Stoddart 4943 (collection lost), Chaloupka and Godwin (1985); Green Island: Smith, Specht and Clapham (1973), Fosberg 61511, Stoddart 4228; Hannah Island: Heatwole, s.n.; Hannibal Island: Heatwole, s.n.; King Island: Walker, sight; Low Isles: Stephenson et al. (1931), Fosberg 59026, Heatwole, s.n., Stoddart 4349; Low Wooded Island: Stoddart 4572; Lowrie Island: Stoddart 5000; Magra Island: Stoddart, sight, King (1989); Masig Island: Walker (1991); Morris Island: Stoddart 4966; Newton Island: Stoddart 4126a; Pelican Island: Stoddart 4931; Pipon Island: Stoddart 4895; Saunders Island: Stoddart 5081, King and Limpus (1989); Sinclair Island: Stoddart 4197; Stainer Island: Stoddart 4195, Chaloupka and Godwin (1985); Stapleton Island: Stoddart 4012; Three Isles: Heatwole, s.n., Stoddart 4482; Turtle III Island: Stoddart 4736; Two Isles: Stoddart 4624; Wallace Island: King et al. (1989b), Walker (1991); West Cairncross Island: Heatwole, s.n., Walker (1991); West Hannibal

Island: Walker (1991); West Hope Island: MacGillivray (1852, I, p. 104) [as *Ipomoea maritima* R. Br.], Walker (1991).

Ipomoea sp.

Douglas Island: Walker (1991); East Hannibal Island: Walker (1991); Masig Island: Walker (1991); West Hannibal Island: Walker (1991).

Jacquemontia paniculata var. *tomentosa* (Warb.) v. Ooststr.

Howick Island: Heatwole, s.n.; Ingram Island: Stoddart 4070, Buckley 3734; Leggatt Island: Buckley 5010.

Jacquemontia sp.

Leggatt Island: Buckley 3717(?).

Merremia sp.

Hannibal Island: Heatwole, s.n. (probably).

Operculina turpethum (L.) Marso

Nymph Island: Heatwole 125.

Xenostegia tridentata L. (Austin & Staples) ssp. *hastata* v. Ooststr.
Merremia hastata Desr.
Merremia tridentata Desr.

Chapman Island: Heatwole, s.n.; Coombe Island: Stoddart 4029; Hannah Island: Heatwole, s.n.; Howick Island: Heatwole, s.n.; Lowrie Island: Buckley 5045; Pelican Island: Buckley 3766; Pipon Island: Heatwole, s.n.; Saunders Island: Stoddart 5071; Three Isles: Heatwole, s.n., Stoddart 4477; Turtle I Island: Buckley 3579; Turtle II Island: Buckley 336l, 3363, 3419; Turtle VI Island: Buckley 3491; Two Isles: Stoddart 4598; Watson Island: Stoddart 4124; West Cairncross Island: Heatwole, s.n., Walker (1991) [as *Xenostegia tridentata*]; West Hannibal Island: Walker (1991) [as *Xenostegia tridentata*].

CUCURBITACEAE

Bryonopsis laciniosa Naud.

East Cairncross Island: Heatwole, s.n.; Three Isles: Heatwole, s.n.; West Cairncross Island: Heatwole, s.n.

Citrullus lanatus var. caffrorum (Alef.) Fosb.

Three Isles: Heatwole, s.n.

Diplocyclos palmatus (L.) Jeffrey

Douglas Island: Buckley 3886, Walker (1991); East Hope Island: Stoddart 4424; Low Wooded Island: Stoddart 4565a; Three Isles: Stoddart 4520; West Hope Island: Stoddart 4418, Walker (1991).

Mukia maderaspatana R. & S.

Arden Island: Walker (1991); Ingram Island: Stoddart 4044; Low Wooded Island: Stoddart 4565b; Turtle III Island: Buckley 3553; Turtle V Island: Buckley 3391, 3537; Turtle VI Island: Buckley 3480 (collection lost).

CYPERACEAE

Bulbostylis barbata C. B. Cl.

Arden Island: Walker (1991); Hannibal Island: Heatwole, s.n.; Hay Island: Buckley 3769; Ingram Island: Buckley 3748b, Stoddart 4081; Newton Island: Stoddart 4131; Turtle I Island: Stoddart 4689; Turtle II Island: Buckley 3412; Turtle III Island: Stoddart 4738; Watson Island: Stoddart 4125; West Cairncross Island: Heatwole, s.n.

Cyperus bifax C. B. Cl.

Pipon Island: Stoddart 4874.

Cyperus javanicus Houtt.

Binstead Island: Stoddart 5049; Low Isles: Stoddart 4328.

Cyperus pedunculatus F. v. M. Cribb and Cribb 1985, 118

Arden Island: Walker (1991); Coombe Island: Buckley 3753; Masig Island: Walker (1991); West Cairncross Island: Walker (1991).

Cyperus rotundus

Arden Island: Walker (1991).

Cyperus scaber (R. Br.) Boeckeler

Masig Island: Walker (1991); Turtle I Island: Buckley 3584, 3585, 3612, Stoddart 4615; Turtle II Island: Buckley 3649; Turtle VI Island: Buckley 3486, 3496(?) (collection missing), 3499.

Cyperus stoloniferus Retz.

Arden Island: Walker (1991); Dalrymple Island: Walker, s.n.; Ingram Island: Buckley 3739; Little Boydong: Buckley 5197; Morris Island: Stoddart 4969; Pelican Island: Stoddart 4921; Pipon Island: Heatwole, s.n.; Stainer Island: Stoddart 4917.

Cyperus sp.

Dove Island: Walker (1991); Masig Island: Walker (1991).

Remirea maritima Aubl.

Coombe Island: Stoddart 4016; Eagle Island: Heatwole, s.n., Buckley 3446, Stoddart 4822, Smith and Buckley (1986); Fife Island: Heatwole, s.n.; Hannibal Island: Heatwole, s.n.; Three Isles: Heatwole, s.n., Stoddart 4504; West Cairncross Island: Heatwole, s.n.; West Hope Island: Stoddart 4395.

Rhynchospora heterochaeta S. T. Blake

Turtle II Island: Buckley 3373.

Cyperaceae indet.

Bramble Cay: Queensland Herbarium (in Walker 1988)

EBENACEAE

Diospyros ferrea var. *compacta* (R. Br.) Fosb.

Low Isles: Henne in Bailey, Fl. Qd., p. 964

Diospyros ferrea var. *humilis* (R. Br.) Bakh.

Aplin Island: Buckley 5257; Bushy Island: Buckley 3881, 5234a, 5235; Green Island: Gardner (1973); Halfway Island: Buckley 5209, 5213, 5215; Ingram Island: Buckley 3733; Three Isles: Stoddart 4473b; Turtle I Island: Buckley 3607; Turtle II Island: Buckley 3427, 4983; Turtle V Island: Buckley 3523; Turtle VI Island: Buckley 3497.

Diospyros ferrea var. *reticulata* (R.Br.) Bakh. Cribb and Cribb 1985, 120

Low Isles: Heatwole, s.n.

Diospyros geminata ((R. Br.) F.v.m.

Three Isles: Heatwole, s.n.

Diospyros maritima Bl. Cribb and Cribb 1985, 120-121

Aplin Island: Buckley 5253; Arden Island: Walker (1991); Douglas Island: Buckley 5243, Walker (1991); Dugong Island: Buckley 5279; East Hope Island: Stoddart 4438, 4452; Farmer Island: Buckley 3816, 5097; Green Island: Smith, Specht and Clapham (1973), Fosberg 61537; Halfway Island: Buckley 5210; Hannibal Island: Heatwole, s.n.; Low Isles: Fosberg 55054, Stoddart 4351; Low Wooded Island: Stoddart 4541; Masig Island: Walker (1991); Tern Island: Buckley 5267; Three Isles: Stoddart 4517; West Cairncross Island: Heatwole, s.n., Walker (1991); West Hannibal Island: Walker (1991); West Hope Island: Stoddart 4408.

Diospyros sp.

Halfway Island: Buckley 3875.

EUPHORBIACEAE

Acalypha amentacea ssp. *wilkesiana* (Muell.-Arg.) Fosberg

Green Island: Specht list, Stoddart 4261, 4279; Low Isles: Fosberg 55050, Heatwole, s.n. (probably), Stoddart 4344.

Breynia oblongifolia Muell.-Arg.

Turtle VI Island: Buckley 3492.

Breynia stipitata Muell.-Arg.

Dugong Island: Buckley 5285; Low Isles: Fosberg 55032; Turtle I Island: Buckley 3586; Turtle II Island: Buckley 3415, 3655.

Claoxylon hillii Benth.

Green Island: Stoddart 4257.

Claoxylon tenerifolium F.v.m. ex Baill.

Green Island: Specht list.

Claoxylon sp.

Green Island: Smith, Specht and Clapham (1973) [probably *C. hillii*].

Drypetes australasica Hutch. ex Pax. & Hoffm.

Bird Island: Buckley 5169, 5175; ; Bushy Island: Buckley 3883, 5220, 5228, 5230, 5236; Dalrymple Island: Walker, s.n.; Farmer Island: Buckley 5094; Fife Island: Chaloupka and Godwin (1985); Green Island: Smith, Specht and Clapham (1973); Hannibal Island: Heatwole, s.n.; Hay Island: Buckley 3777; Howick Island: Heatwole, s.n.; MacArthur Island: Buckley 5183,5186; Three Isles: Stoddart 4473; Turtle I Island: Stoddart 4675, 4693,4694,4722; Turtle VI Island: Buckley 3511; Two Isles: Stoddart 4656; West Hannibal Island: Walker (1991); West Cairncross Island: Heatwole, s.n., Walker (1991).

Endospermum medulosum L. S. Smith

West Hope Island: Walker (1991).

Euphorbia chamissonis (Kl. & Gke.) Boiss. — Cribb and Cribb 1985, 122-123
Euphorbia atoto sensu auct. non Forst f. — (as *Euphorbia atoto*)

Arden Island: Walker (1991) [as *Euphorbia atoto*]; Coombe Island: Stoddart 4023; Dalrymple Island: Walker (1991); Dove Island: Walker (1991) [as *Euphorbia atoto*]; Eagle Island: Heatwole, s.n., Stoddart 4821; Fife Island: Steers (1938), Stoddart 4949, Chaloupka and Godwin (1985) [as *Chamaesyce atoto*]; Green Island: Gardner (1973), Specht list, Stoddart 4230; Hannibal Island: Heatwole, s.n.; Howick Island: Heatwole, s.n., Stoddart 4857; Ingram Island: Buckley 3725(?), Stoddart 4045; Low Isles: Heatwole, s.n., Stoddart 4346; Magra Island: Buckley 3838, King (1989) [as *Euphorbia atoto*]; Masig Island: Walker (1991) [as *Euphorbia atoto*]; Morris Island: Stoddart 4986; Newton Island: Stoddart 4133; Pelican Island: Stoddart 4932; Saunders Island: Buckley 3846, Stoddart 5073; Sinclair Island: Stoddart 4190; Stainer Island: Chaloupka and Godwin (1985); Three Isles: Heatwole, s.n., Stoddart 4470; Two Isles: Stoddart 4613; West Cairncross Island: Walker (1991) [as *Euphorbia atoto*]; West Hannibal Island: Walker (1991) [as *Euphorbia atoto*].

Euphorbia cyathophora Murr. — Cribb and Cribb 1985, 123

Green Island: Smith, Specht and Clapham (1973), Stoddart 4274; Masig Island: Walker (1991).

Euphorbia heterophylla L.

Green Island: Smith, Specht and Clapham (1973).

Euphorbia hirta L.

Arden Island: Walker (1991); Dalrymple Island: Walker, s.n.; Hannah Island: Heatwole, s.n.; Low Isles: Fosberg 55030, Stoddart 4355 (collection lost); Masig Island: Walker (1991); Morris Island: Buckley 3788, Stoddart 4964; Three Isles: Heatwole, s.n.; Turtle I Island: Stoddart 4672.

Euphorbia pulcherrima Willd. ex Kl.

Green Island: Gardner (1973).

Euphorbia sparrmannii Boiss.

Pipon Island: Stoddart 4885.

Euphorbia tannensis Spreng. Cribb and Cribb 1985, 123-124

Coombe Island: Stoddart 4033; Douglas Island: Walker (1991); Eagle Island: Heatwole, s.n., Stoddart 4820; East Hope Island: Stoddart 4368; Farmer Island: Buckley 3819(?), Walker: sight; Fife Island: Heatwole, s.n., Stoddart 4950, Chaloupka and Godwin (1985) [as *Chamaesyce tannensis*]; Green Island: Gardner (1973), Specht list, Fosberg 61504, Stoddart 4227; Hannah Island: Heatwole, s.n.; Hannibal Island: Heatwole, s.n.; Howick Island: Heatwole, s.n., Stoddart 4856; Ingram Island: Stoddart 4038, 4066; Low Isles: Stephenson et al. (1931) [as *Euphorbia eremophila*], Fosberg 55042, Heatwole, s.n., Stoddart 4307; Low Wooded Island: Stoddart 4560; Magra Island: King (1989); Masig Island: Walker (1991); Morris Island: Stoddart 4982; Newton Island: Stoddart 4134; Nymph Island: Heatwole 131; Pelican Island: Stoddart 4933; Pipon Island: Heatwole, s.n., Stoddart 4894; Saunders Island: Stoddart 5084; Sinclair Island: Stoddart 4192; Three Isles: Mueller in Bailey, Fl. Qd., p. 1400, Heatwole, s.n, Stoddart 4505; Turtle I Island: Stoddart 4670; Turtle II Island: Buckley 3396, 3656; Turtle III Island: Stoddart 4757; Two Isles: Stoddart 4616; West Cairncross Island: Heatwole, s.n.; West Hannibal Island: Walker (1991); West Hope Island: Stoddart 4383.

Excoecaria agallocha L. Cribb and Cribb 1985, 219

Baird III Island: Buckley 3834; Bewick Island: Stoddart 4166; Binstead Island: Buckley 3802; Chapman Island: Stoddart 5042, Buckley 3811; East Pethebridge Island: Stoddart 4765; Fisher Island: Buckley 5087, Stoddart 5103; Hannibal Island: Buckley 5194; Howick Island: Stoddart 4206; Leggatt Island: Buckley 5004, 5017; Low Isles: Stephenson et al. (1931), Stoddart 4325; Low Wooded Island: Stoddart 4546; Lowrie Island: Buckley 3797, 5037, Stoddart 4994; MacArthur Island: Buckley 3853(?), 5180, 5181; Newton Island:

Stoddart , sight; Nymph Island: Stoddart, sight; Turtle I Island: Stoddart 4700; Turtle II Island: Buckley 3643, 3647; Turtle IV Island: Stoddart, sight; Turtle V Island: Stoddart, sight; West Hope Island: Stoddart 4388; West Pethebridge Island: Stoddart 4778.

Flueggia microcarpa Blume

Howick Island: Mueller in Bailey, Fl. Qd., p. 1426 [as 'Howick's Group'].

Glochidion sp.

Green Island: Specht list.

Macaranga tanarius Muell.-Arg. Cribb and Cribb 1985, 124-125

Green Island: Cairns City Council (1933), Smith, Specht and Clapham (1973), Stoddart 4276; Howick Island: Mueller in Bailey, Fl. Qd., p. 1452 [as 'Howick's Group']; Low Wooded Island: Stoddart 4556; Masig Island: Walker (1991); Three Isles: Heatwole, s.n., Stoddart 4474, 4485.

Mallotus nesophilus Muell.-Arg.

Green Island: Specht list.

Mallotus paniculatus (Lam.) Muell.-Arg.

Green Island: Gardner (1973), Specht list.

Mallotus repandus Muell.-Arg.

Three Isles: Stoddart 4519.

Pedilanthus tithymaloides (L.) Poit.

Green Island: Stoddart 4270; Low Isles: Stoddart 4302.

Phyllanthus amarus Schum.

Low Isles: Fosberg 55031; West Cairncross Island: Heatwole, s.n., Walker (1991).

Phyllanthus novae-hollandiae Muell.-Arg.

Arden Island: Walker (1991); Bushy Island: Buckley 5231; Dalrymple Island: Walker, s.n.; Farmer Island: Buckley 3820; Ingram Island: Buckley 3741c(?), 3742(?); Pelican Island: Buckley 3765(?); Turtle II Island: Buckley 3666; West Hope Island: Walker (1991) (?).

Phyllanthus reticulatus Poit.

East Cairncross Island: Heatwole, s.n.; East Hope Island: Stoddart 4431; Hannibal Island: Heatwole, s.n.; Ingram Island: Stoddart 4055; Pelican Island: Stoddart 4924; Turtle I Island: Buckley 3591(?); ; Turtle II Island: Buckley 3402(?); Turtle V Island: Buckley 3540(?); Turtle VI Island: Buckley 3504(?); West Cairncross Island: Heatwole, s.n., Walker (1991); West Hope Island: Walker (1991).

Phyllanthus tenellus Roxb.

Hannibal Island: Heatwole, s.n.; West Hannibal Island: Walker (1991).

Phyllanthus sp.

Fife Island: Chaloupka and Godwin (1985); Wallace Island: King et al. (1989b), Walker (1991).

Synostemon bacciformis (L.) Webster

Ingram Island: Stoddart 4066.

EUPOMATIACEAE

Eupomatia cf. bennettii F. v. M.

Low Isles: Fosberg 55049.

Eupomatia (?)

West Hope Island: Walker (1991).

FABACEAE (LEGUMINOSAE)

Abrus precatorius L. Cribb and Cribb 1985, 126

Arden Island: Walker (1991); Dalrymple Island: Walker, s.n.; Douglas Island: Walker (1991); Dove Island: Walker (1991); Eagle Island: Stoddart 4831; Fife Island: Stoddart 4963, Chaloupka and Godwin (1985); Green Island: Smith,

Specht and Clapham (1973); Hannah Island: Heatwole, s.n.; Hannibal Island: Heatwole, s.n.; Howick Island: Heatwole, s.n., Stoddart 4865; Ingram Island: Stoddart 4076; Low Isles: Stoddart 4329; Low Wooded Island: Stoddart 4531; Morris Island: Stoddart 4976; Pelican Island: Stoddart 4925; Turtle I Island: Buckley 3572, Stoddart 4678; Turtle II Island: Buckley 3421, 3648; Two Isles: Stoddart 4651; West Cairncross Island: Heatwole, s.n., Walker (1991); West Hannibal Island: Walker (1991); West Hope Island: Stoddart 4410, Walker (1991).

Acacia oraria F. v. M.

Turtle I Island: Buckley 3581, Stoddart 4690.

Bauhinia binata Blanco

Hannibal Island: Heatwole, s.n., West Hannibal Island: Walker (1991).

Bauhinia hookeri F. v. M.

Hannah Island: Heatwole, s.n.; Newton Island: Stoddart 4144; Turtle I Island: Buckley 3610, Stoddart 4723; Turtle II Island: Buckley 3416.

Bossiaea sp.

West Hope Island: MacGillivray (1852, I, p. 104) [as *Bossioea*].

Caesalpinia bonduc (L.) Roxb. Cribb and Cribb 1985, 103-104, 257

Arden Island: Walker (1991); Binstead Island: Buckley 3803, Stoddart 5013 (collection lost); Dove Island: Walker (1991); East Cairncross Island: Heatwole, s.n.; East Hannibal Island: Walker (1991); East Hope Island: MacGillivray (1852, I, p. 105) [as *Guilandina bonduc*], Stoddart, sight; Fife Island: Chaloupka and Godwin (1985); Green Island: Smith, Specht and Clapham (1973), Fosberg 61515(?), Stoddart 4238(?); Hannibal Island: Heatwole, s.n., Walker, sight; Howick Island: Heatwole, s.n.; Low Isles: Stoddart 4321; Masig Island: Walker (1991); Sherrard Island: Stoddart 5027 (collection lost); Three Isles: Stoddart 4494; Turtle I Island: Buckley 3599; West Cairncross Island: Walker (1991); West Hannibal Island: Walker (1991); West Hope Island: Walker (1991).

Caesalpinia pulcherrima (L.) Sw.

Green Island: Gardner (1973), Stoddart 4263.

Caesalpinia major (Medic.) Dandy & Exell
Low Wooded Island: Stoddart 4589; West Hope Island: Stoddart 4397.

Canavalia rosea (Sw.) DC. Cribb and Cribb 1985, 127
Canavalia maritima (Aubl.) Urb.
Canavalia obtusifolia (Lam.) DC.

Bewick Island: Stoddart 4180; Bushy Island: Buckley 3885; Chapman Island: Heatwole, s.n.; Coquet Island: Walker, sight; Dove Island: Walker (1991); Eagle Island: Stoddart 4818; East Hope Island: Stoddart 4444; Farmer Island: Walker, sight; Fife Island: Steers (1938), Buckley 3785, Chaloupka and Godwin (1985); Green Island: Smith, Specht and Clapham (1973), Stoddart 4226; Hannibal Island: Heatwole, s.n.; Howick Island: Heatwole, s.n.; Ingram Island: Stoddart 4051; Low Wooded Island: Stoddart 4548; Masig Island: Walker (1991); Newton Island: Stoddart 4137; Pipon Island: Heatwole, s.n.; Stoddart 4896; Three Isles: Stoddart 4484; Turtle I Island: Buckley 3587, Stoddart 4679; Turtle III Island: Stoddart 4741; Turtle V Island: Buckley 3390; Two Isles: Stoddart 4604; Watson Island: Stoddart 4106, 4120; West Cairncross Island: Walker (1991); West Hannibal Island: Walker (1991); West Hope Island: Walker (1991).

Canavalia sericea A. Gray

Green Island: Specht list.

Cassia occidentalis L.

Green Island: Gardner (1973) [as *Cassia* sp.]; Morris Island: Stoddart, sight; Pipon Island: Heatwole, s.n., Stoddart 4883.

Crotalaria linifolia L.f.

Nymph Island: Heatwole 128, 137.

Crotalaria medicaginea Lam.

Hay Island: Buckley 3772; Leggatt Island: Buckley 3714(?).

Crotalaria pallida Ait.

Green Island: Smith, Specht and Clapham (1973) [as *Crotalaria* sp. *cf. lanceolatum*], Fosberg 61506, Stoddart 4225; Low Isles: Fosberg 55035, Heatwole, s.n., Stoddart 4303.

Crotalaria trifoliastrum Willd. var. *trifoliastrum*

Fife Island: Heatwole, s.n.

Crotalaria sp.

Nymph Island: Heatwole 137.

Dalbergia candenatensis (Dennst.) Prain — Cribb and Cribb 1985, 127-128

Low Isles: Fosberg, sight.

Derris trifoliata Lour. — Cribb and Cribb 1985, 129

Green Island: Smith, Specht and Clapham (1973); Turtle V Island: Buckley 3535, 3548, 3549; West Hope Island: Walker (1991).

Desmodium sp. aff. *trichostachyon* Benth.

Turtle II Island: Buckley 3374.

Erythrina insularis Bailey

Bird Island: MacGillivray (1852, I, p. 119) [as *Erythrina*], Stoddart 5090; Farmer Island: MacGillivray (1852, I, p.1170 [as *Erythrina*], Stoddart, sight; Turtle I Island: Bailey in Bailey, Fl. Qd., p. 428 [as 'Turtle Island'].

Erythrina phlebocarpa Bailey

Douglas Island: Walker (1991) (?); Green Island: Smith, Specht and Clapham (1973); Hannibal Island: Heatwole, s.n.; Low Isles: Fosberg, sight; West Hannibal Island: Walker (1991).

Erythrina variegata var. *orientalis* (L.) Merr. — Cribb and Cribb 1985, 130

Green Island: Cairns City Council (1933), Gardner (1973) [as *Erythrina indica* var. *variegata*], Specht list, Stoddart 4247.

Erythrina vespertilio Benth.

Bird Island: Buckley 5176(?); Farmer Island: Buckley 3821, 5098; Green Island: Specht list.

Erythrina sp.

Green Island: St John (1967) [probably *Erythrina variegata* var. *orientalis*].

Leucaena leucocephala (Lam.) de Wit

Dove Island: Walker (199); Green Island: Specht list.

Pithecellobium grandiflorum Benth.

Green Island: Gardner (1973), Specht list, Stoddart 4285; Three Isles: Stoddart 4481.

Pithecellobium lovellae F. M. Bailey

Green Island: Cairns City Council (1933).

Pongamia pinnata (L.) Merr. Cribb and Cribb 1985, 132

Green Island: Cairns City Council (1933), Smith, Specht and Clapham (1973), Fosberg 61536, Stoddart 4239; Low Isles: Fosberg, sight; West Hope Island: Walker (1991).

Rhynchosia australis Benth.

Howick Island: Heatwole, s.n.

Rhynchosia cunninghamii Benth.

Green Island: Cairns City Council (1933) [this may be *Rhynchosia minima* DC.].

Rhynchosia minima DC.

Dalrymple Island: Walker, s.n.; Turtle I Island: Buckley 3580; Turtle II Island: Buckley 3362.

Sesbania cannabina (Retz.) Pers.

Raine Island: Hacker (1990); Stainer Island: Buckley 3760.

Sesbania sp.

Raine Island: Stoddart 5050 (probably *Sesbania cannabina*).

Sophora tomentosa L. Cribb and Cribb 1985, 133

Arden Island: Walker (1991); Dove Island: Walker (1991); Eagle Island: Stoddart 4800; East Cairncross Island: Heatwole, s.n.; East Hope Island:

Stoddart 4370; Farmer Cay: Walker, sight; Green Island: R. Roe in 1937 (S), Cairns City Council (1933), Smith, Specht and Clapham (1973), Fosberg 61520, Stoddart 4240; Low Wooded Island: Stoddart 4570; Sinclair Island: Stoddart 4193; Turtle I Island: Buckley 3588; Turtle II Island: Buckley 3375, Stoddart, sight; Turtle III Island: Stoddart 4733; Two Isles: Stoddart 4612; West Cairncross Island: Heatwole, s.n., Walker (1991); West Hope Island: Stoddart 4396, Walker (1991).

Vigna marina (Burm.) Merr. Cribb and Cribb 1985, 133-134

Arden Island: Walker (1991); Beesley Island: Stoddart, sight; Chapman Island: Stoddart, sight; Eagle Island: Heatwole, s.n., Stoddart 4823; East Hope Island: Stoddart 4376; Green Island: R. Roe in 1937(S), Smith, Specht and Clapham (1973), Fosberg 61507, Stoddart 4233; Halfway Island: Buckley 3872; Houghton Island: Stoddart, sight; Ingram Island: Stoddart 4068; Low Isles: Stephenson et al. (1931), Fosberg 55038, Heatwole, s.n., Stoddart 4301; Masig Island: Walker (1991); Morris Island: Stoddart, sight; Nymph Island: Stoddart, sight; Pipon Island: Stoddart 4878; Sinclair Island: Buckley 3904, Stoddart 4195; Three Isles: Stephenson 650, Tandy and Stephenson 642, Heatwole, s.n., Stoddart 4491 (collection lost); Two Isles: Stoddart 4611; West Hope Island: Stoddart 4454, Walker (1991).

FLAGELLARIACEAE

Flagellaria indica L.

Bewick Island: Stoddart 4088; Binstead Island: Stoddart 5007 (collection lost); Douglas Island: Walker (1991); Eagle Island: Stoddart 4805; East Cairncross Island: Heatwole, s.n.; East Hope Island: Stoddart 4434; Fife Island: Heatwole, s.n., Stoddart 4962, Chaloupka and Godwin (1985); Green Island: Smith, Specht and Clapham (1973), Stoddart 4281; Hannibal Island: Heatwole, s.n.; Ingram Island: Buckley 3744, Stoddart 4053; Low Isles: Stephenson et al. (1931), Stoddart 4326; Low Wooded Island: Stoddart 4535; Masig Island: Walker (1991); Nymph Island: Heatwole 140; Pipon Island: Heatwole, s.n., Stoddart 4898; West Hannibal Island: Walker (1991); West Cairncross Island: Walker (1991); West Hope Island: Stoddart 4463, Walker (1991).

GOODENIACEAE

Scaevola sericea Vahl Cribb and Cribb 1985, 135-136
Scaevola taccada (Gaertn.) Roxb.
Scaevola koenigii Vahl

Arden Island: Walker (1991); Bird Island: Stoddart, sight; Coombe Island: Stoddart 4025; Dalrymple Island: Walker, s.n.; Dove Island: Walker (1991); Eagle Island: Heatwole, s.n., Stoddart 4799, Smith and Buckley (1986); East Cairncross Island: Heatwole, s.n.; East Hope Island: Stoddart 4440; Fife Island: Steers (1938) [as *Scaevola frutescens*]; Green Island: Cairns City Council (1933) [as *Scaevola koenigii*], Smith, Specht and Clapham (1973), St John

(1962), Fosberg 61509, Stoddart 4248; Hannibal Island: Heatwole, s.n., Walker, sight; Howick Island: Heatwole, s.n., Stoddart 4851; Ingram Island: Stoddart 4039; Low Isles: R. Brown in Bailey, Fl. Qd., p. 907 [as *Scaevola koenigii*],Stephenson et al. (1931) [as *Scaevola koenigii*], Heatwole, s.n., Fosberg 55037, Stoddart 4300; Low Wooded Island: Stoddart 4544; Magra Island: Stoddart, sight, King (1989); Masig Island: Walker (1991); Morris Island: Stoddart 4975; Saunders Island: Stoddart 5088, King and Limpus (1989) [as *Scaevola* sp.]; Three Isles: Stoddart 4495 (collection lost); Turtle I Island: Stoddart 4685; Turtle II Island: Stoddart, sight; Turtle III Island: Stoddart 4732; Turtle IV Island: Stoddart, sight; Two Isles: Stoddart 4610; West Cairncross Island: Heatwole, s.n., Walker (1991); West Hannibal Island: Walker (1991); West Hope Island: Stoddart 4412, Walker (1991).

GUTTIFERAE

Calophyllum inophyllum L. — Cribb and Cribb 1985, 112-113, 262

Fife Island: Chaloupka and Godwin (1985); Green Island: Cairns City Council (1933), Smith, Specht and Clapham (1973), Stoddart 4253; Low Isles: Fosberg 55048, Stoddart 4320, 4364.

Calophyllum sil Lauterb.

Green Island: Specht list.

HERNANDIACEAE (including GYROCARPACEAE)

Gyrocarpus americanus Jacq.

Arden Island: Walker, s.n., Walker (1991); Douglas Island: Walker (1991); Hannibal Island: Heatwole, s.n.; West Cairncross Island: Walker (1991); West Hannibal Island: Walker (1991).

Hernandia sonora L. — Cribb and Cribb 1985, 137
Hernandia peltata Meisn.

West Hope Island: Stoddart 4398.

HYDROCHARITACEAE

Enhalus acoroides (L.f.) Royle — Cribb and Cribb 1985, 242

Low Isles: Stoddart 4299.

Halophila minor (Miq. ex Zoll.) Den Hartog
Halophila ovata sensu auct. non Gaud.

Low Isles: Fosberg 55023, Stoddart 4310; Low Wooded Island: Stoddart 4533; Nymph Island: Stoddart 4739; Pipon Island: Stoddart 4909.

Halophila ovalis (R. Br.) Hook. f. Cribb and Cribb 1985, 242-243

Green Island: S. T. Blake 22083 (in Den Hartog 1970), Den Hartog 909 (in Den Hartog 1970), Fosberg 55022; Howick Island: Tandy (in Den Hartog 1970); Low Isles: Tandy 102 (in Den Hartog 1970), Den Hartog 991 (in Den Hartog 1970); Turtle I Island: Tandy (in Den Hartog 1970) [as 'Turtle Island'].

Halophila spinulosa (R. Br.) Aschers.Cribb and Cribb 1985, 243-244

Turtle I Island: Tandy (in Den Hartog 1970) [as 'Turtle Island'].

Thalassia hemprichii (Ehrb.) Aschers. Cribb and Cribb 1985, 244-245

Bird Island: Stoddart 5094; Green Island: Den Hartog 900 (in Den Hartog 1970); Low Isles: Tandy (in Den Hartog 1970), Den Hartog 992 (in Den Hartog 1970), Fosberg 55020, Stoddart 4309, 4360; Low Wooded Island: Stoddart 4532; Pipon Island: Stoddart 4907.

ICACINACEAE

Gomphandra australiana F.v.m.
Green Island: Specht list.

LAMIACEAE (LABIATAE)

Hyptis suaveolens (L.) Poit.

Low Isles: Fosberg 55027, Heatwole, s.n.

LAURACEAE

Cassytha filiformis L. Cribb and Cribb 1985, 139-140

Arden Island: Walker (1991); Coombe Island: Stoddart 4018; Coquet Island: Walker, sight; Dove Island: Walker (1991); Eagle Island: Heatwole, s.n., Stoddart 4825; East Hope Island: Stoddart 4447; Fife Island: Heatwole, s.n., Stoddart 4960, Chaloupka and Godwin (1985); Green Island: Smith, Specht and Clapham (1973), Fosberg 61505, Stoddart 4229; Hannibal Island: Heatwole, s.n.; Howick Island: Mueller in Bailey, Fl. Qd., p. 1314 [as 'Howick Group'], Heatwole, s.n., Stoddart 4844; Ingram Island: Stoddart 4080; Low

Isles: Stephenson et al. (1931), Heatwole, s.n.; Low Wooded Island: Stoddart 4588; Masig Island: Walker (1991); Morris Island: Stoddart 4988; Nymph Island: Heatwole, s.n., Stoddart, sight; Saunders Island: Stoddart 5089; Three Isles: Heatwole, s.n., Stoddart 4591; Turtle V Island: Stoddart, sight; Turtle VI Island: Buckley 3501; Two Isles: Stoddart 4599; West Cairncross Island: Heatwole, s.n., Walker (1991); West Hannibal Island: Walker (1991); West Hope Island: Stoddart 4457, Walker (1991).

Cassytha glabella R. Br. Cribb and Cribb 1985, 268

Nymph Island: Heatwole 142(?).

Cassytha pubescens R. Br.

Turtle II Island: Buckley 3359.

Cryptocarya cunninghamii Meisn.

Green Island: Specht list.

Cryptocarya hypospodia F.v.M.

Green Island: Specht list.

Cryptocarya sp.

Fife Island: Chaloupka and Godwin (1985).

LILIACEAE

Dianella caerulea Sims. sensu lato

Turtle I Island: Stoddart 4687.

Schelhammera multiflora R. Br.

Green Island: Smith, Specht and Clapham (1973).

LORANTHACEAE

Loranthus odontiocalyx F. v. M.

Howick Island: Mueller in Bailey, Fl. Qd., p. 1381 [as 'Howick's Group'].

Loranthus quandang Lindl.

Howick Island: Mueller in Bailey, Fl. Qd., p. 1381 [as 'Howick's Group'].

LYTHRACEAE

Pemphis acidula Forst. Cribb and Cribb 1985, 145

Arden Island: Walker (1991); Arnold Island: Buckley 3907; Beanley Island: Stoddart, sight; Bewick Island: Stoddart 4095, 4194; Binstead Island: Stoddart 5017 (collection lost); Bird Island: Stoddart 5092; Chapman Island: Heatwole, s.n., Stoddart 5039; Coquet Island: Stoddart, sight; Dalrymple Island: Walker, s.n.; Douglas Island: Walker (1991); East Cairncross Island: Heatwole, s.n.; East Hannibal Island: Walker (1991); East Pethebridge Island: Stoddart 4767; Fisher Island: Stoddart 5099; Hannah Island: Heatwole, s.n.; Hannibal Island: Heatwole, s.n.; Houghton Island: Stoddart, sight; Howick Island: Heatwole, s.n., Stoddart 4846; Ingram Island: Stoddart 4062; Leggatt Island: Stoddart, sight; Low Wooded Island: Stoddart 4557; Lowrie Island: Buckley 3794, Stoddart 4995; Newton Island: Stoddart 4151; Nymph Island: Heatwole 130, Stoddart , sight; Pipon Island: Stoddart 4899; Saunders Island: Stoddart 5083; Sherrard Island: MacGillivray (1852, I, p. 116) [as *Pemphis acida*], Stoddart 5024 (collection lost); Three Isles: MacGillivray (1852, I, pp. 105-106) [as *Pemphis acida*], Stephenson et al. (1931), Heatwole, s.n., Stoddart 4490 (collection lost); Turtle I Island: Stoddart 4688; Turtle II Island: Buckley 3424, 3658, Stoddart 4490; Turtle III Island: Stoddart 4753; Turtle IV Island: Buckley 3566, Stoddart, sight; Turtle V Island: Buckley 3531, Stoddart, sight; Turtle VI Island: Stoddart, sight; Two Isles: Stoddart 4630; West Cairncross Island: Heatwole, s.n., Walker (1991); West Hannibal Island: Walker (1991); West Hope Island: Stoddart 4381, Walker (1991); West Pethebridge Island: Stoddart 4775.

MALVACEAE

Abutilon asiaticum Miquel var. *australiense* (Hochr. ex Britt.) Fosb.
Abutilon indicum sensu auct. non (L.) Sweet Cribb and Cribb 1985, 146-147
Abutilon albescens

Arden Island: Walker (1991); Chapman Island: Heatwole, s.n., Stoddart 5048; Coombe Island: Stoddart 4024; Douglas Island: Walker (1991); Eagle Island: Heatwole, s.n., Stoddart 4817; East Hope Island: Stoddart 4433; Farmer Island: Walker, sight; Fife Island: Steers (1938) [as *Abutilon* sp.], Heatwole, s.n., Stoddart 4957, Chaloupka and Godwin (1985); Green Island: Smith, Specht and Clapham (1973) [as *Abutilon* sp.]; Hannah Island: Heatwole, s.n.; Hannibal Island: Heatwole, s.n.; Ingram Island: Buckley 3737; King Island: Walker, sight; Low Wooded Island: Stoddart 4549; Magra Island: King (1989) [as *Abutilon indicum*]; Masig Island: Walker (1991); Morris Island: MacGillivray (1852, I, p. 115) [as *Sida* on 'Claremont No VI' Island], Stoddart 4979; Newton Island: Stoddart 4145; Nymph Island: Stoddart, sight; Pelican Island: MacGillivray (1852, I, p. 115) [as *Sida*], Stoddart 4927; Piper's Island: Bailey, Fl. Qd., p. 119 [as *Abutilon graveolens* W. & A.]; Pipon Island: Heatwole, s.n., Stoddart 4888; Raine Island: Stoddart 5052, Hacker (1990);

Saunders Island: Stoddart 5079, King and Limpus (1989) [as *Abutilon indicum*]; Sherrard Island: Stoddart, sight; Sinclair Island: Stoddart 4183; Stainer Island: Buckley 3764(?), Stoddart 4911, Chaloupka and Godwin (1985); Stapleton Island: Stoddart 4005; Three Isles: Stoddart 4509; Turtle I Island: Stoddart 4716; Turtle V Island: Buckley 3388, 3536; Two Isles: Stoddart 4600; Wallace Island: King et al. (1989b) [as *Abutilon indicum*], Walker (1991); West Cairncross Island: Walker (1991); West Hannibal Island: Walker (1991); West Hope Island: Stoddart 4389, Walker (1991).

Hibiscus tiliaceus L. Cribb and Cribb 1985,147-148

Arden Island: Walker (1991); Dove Island: Walker (1991); Green Island: Cairns City Council (1933), Fosberg 61525, Stoddart 4242; Hannibal Island: Heatwole, s.n.; Low Wooded Island: Stoddart 4580; Masig Island: Walker (1991); Two Isles: Stoddart 4623; West Hannibal Island: Walker (1991).

Hibiscus sp. *cf. rosa-sinensis* L.

Green Island: Stoddart 4278.

Modiola sp.

Green Island: Gardner (1973).

Sida rhombifolia L. (?)

Hannibal Island: Heatwole, s.n. (possibly); Low Isles: Fosberg 55034.

Sida spinosa L.

Arden Island: Walker (1991); Little Boydong: Buckley 3865; MacArthur Island: Buckley 3847; Morris Island: Buckley 3790; Wallace Island: Buckley 3871; West Hope Island: Walker (1991) (?).

Thespesia populnea (L.) Sol. ex Correa Cribb and Cribb 1985, 148-149

Bewick Island: Stoddart 4092; Buchan Island: Buckley 3842(?); Bushy Island: Buckley 5218; East Cairncross Island: Heatwole, s.n.; East Hope Island: Stoddart 4369; Green Island: Cairns City Council (1933), St John (1962), Smith, Specht and Clapham (1973), Stoddart 4245; Halfway Island: Buckley 5211; Houghton Island: Stoddart, sight; Howick Island: Stoddart 4854; Ingram Island: Stoddart 4060; Leggatt Island: Buckley 3716, Stoddart, sight; Low Isles: Stephenson et al. (1931), Stoddart 4332; Low Wooded Island: Stoddart 4586; Lowrie Island: Stoddart 5001; Masig Island: Walker (1991); Pipon Island: Stoddart 4893; Three Isles: Stoddart 4493 (collection lost); Turtle III Island: Buckley 3560, Stoddart 4731; Wallace Island: King et al. (1989b), Walker (1991); Watson Island: Stoddart 4109; West Hope Island: Stoddart 4384, Walker (1991).

Thespesia populneoides (Roxb.) Kosteletsky

Dalrymple Island: Walker, s.n.; Hannah Island: Heatwole, s.n.; Hannibal Island: Heatwole, s.n.; Newton Island: Stoddart 4141; West Hannibal Island: Walker (1991).

Thespesia sp.

Douglas Island: Walker (1991); Turtle V Island: Buckley 3667(?).

MELIACEAE

Aglaia elaeagnoides Benth. Cribb and Cribb 1985, 151

Green Island: Smith, Specht and Clapham (1973); Halfway Island: Buckley 3878; Low Wooded Island: Stoddart 4555; Three Isles: Stoddart 4511; Turtle I Island: Buckley 3601, Stoddart 4674; Turtle VI Island: Buckley 3512; Two Isles: Stoddart 4596.

Dysoxylum muelleri Benth.

Green Island: Specht list.

Melia azedarach var.
Melia composita Willd.

Green Island: Cairns City Council (1933) [as *Melia composita*], Smith, Specht and Clapham (1973).

Pseudocarapa nitudula (Benth.) Merr. & Perry

Green Island: Specht list.

Turraea brownii C. DC.

Dalrymple Island: Walker, s.n.; Dove Island: Walker (1991); Hannibal Island: Heatwole, s.n.; West Hannibal Island: Walker (1991).

Vavaea amicorum Benth.

Green Island: Specht list; Turtle I Island: Buckley 3575.

Xylocarpus australasicus Ridley

Bewick Island: Thom [as Stoddart 4173]; Binstead Island: Stoddart 5015; Farmer Island: Buckley 5099; Fisher Island: Buckley 5092, Stoddart 5100; Lowrie Island: Buckley 5039.

Xylocarpus granatum (L.) Koen. Cribb and Cribb 1985, 220-221, 272

Binstead Island: Buckley 5059, 5060; Bushy Island: Buckley 3860; Hannibal Island: Heatwole, s.n.; MacArthur Island: Buckley 5179; Turtle II Island: Buckley 3645; West Pethebridge Island: Stoddart 4791.

Xylocarpus moluccensis (Lam.) Roem.

Bewick Island: Thom [as Stoddart 4169]; Fisher Island: Buckley 5089.

MENISPERMACEAE

Hypserpa decumbens (Benth.) Diels

Hannah Island: Heatwole, s.n.

Pachygone ovata Miers ex Hook. f. & Thoms

Fife Island: Chaloupka and Godwin (1985); Green Island: Specht list; West Cairncross Island: Heatwole, s.n., Walker (1991); West Hope Island: Walker (1991).

Pycnarrhena sp.

Green Island: Specht list.

Tinospora smilacina Benth.

Arden Island: Walker (1991); East Hope Island: Stoddart 4435; Hannah Island: Heatwole, s.n.; Hannibal Island: Heatwole, s.n.; Hay Island: Buckley 3770; Turtle I Island: Buckley 3576, 3606; Turtle II Island: Buckley 3360, 3398; Turtle VI Island: Buckley 3520; West Hope Island: Walker (1991).

MORACEAE

Cudrania cochinchinensis (Lour.) Kudo & Masam

Fife Island: Chaloupka and Godwin (1985); Green Island: Specht list.

Cudrania javanensis (Miq.) Trec.

Green Island: Smith, Specht and Clapham (1973), Fosberg 61530.

Ficus benjamina L.

Green Island: Specht list.

Ficus coronata Reinw. ex Bl.

Hannibal Island: Heatwole, s.n. (possibly juvenile); Three Isles: Heatwole, s.n.

Ficus drupacea Thunb. Cribb and Cribb 1985, 156

Bird Island: Buckley 5172; Bushy Island: Buckley 3884(?), 5224; Douglas Island: Buckley 5248, Walker (1991); Green Island: Specht list, Stoddart 4241; Hannibal Island: Heatwole, s.n.; Low Isles: Fosberg 55052, Stoddart 4345; MacArthur Island: Buckley 5189; West Hannibal Island: Walker (1991).

Ficus fraseri Miq.

Sinclair Island: Stoddart 4176.

Ficus hispida L.f.

Hannibal Island: Heatwole, s.n.

Ficus infectoria Roxb.

Green Island: Cairns City Council (1933).

Ficus microcarpa L.

Green Island: Gardner (1973), Specht list.

Ficus obliqua Forst. f. Cribb and Cribb 1985, 156-157 (var. *petiolaris*)

Douglas Island: Walker (1991) (?); Green Island: Smith, Specht and Clapham (1973) [var. *petiolaris*]; Little Boydong: Buckley 3867; Two Isles: Stoddart 4625, 4653; West Hannibal Island: Walker (1991) (?).

Ficus opposita Miq. Cribb and Cribb 1985, 157-158

Bushy Island: Buckley 5227; Fife Island: Heatwole, s.n., Chaloupka and Godwin (1985); Green Island: Smith, Specht and Clapham (1973); Howick Island: Stoddart 4861; Ingram Island: Buckley 3731(?), 5019; Low Wooded Island: Stoddart 4542; Masig Island: Walker (1991); Nymph Island: Heatwole 134; Saunders Island: Buckley 3844; Sinclair Island: Buckley 3704; Three Isles: Heatwole, s.n., Stoddart 4475; Turtle I Island: Buckley 3569, Stoddart 4721; Turtle VI Island: Buckley 3487; Two Isles: Stoddart 4658.

Ficus pilosa Reinw.

Green Island: Cairns City Council (1933).

Ficus virens var. *sublanceolata* (Miq.) Corner

Arden Island: Walker (1991); Green Island: Specht list; Masig Island: Walker (1991); West Cairncross Island: Heatwole, s.n., Walker (1991).

Ficus aff. *virens* Ait.

Bushy Island: Buckley 5223, 5225; Dugong Island: Buckley 5286b.

Ficus sp.

Coquet Island: Walker, sight; Douglas Island: Walker (1991); Green Island: Fosberg 61521, 61528, 61535; Farmer Island: Walker, sight; Hannibal Island: Walker, sight; Ingram Island: Buckley 3729; Low Isles: Fosberg 55052; MacArthur Island: Buckley 3854; Masig Island: Walker (1991); Pipon Island: King (1986); West Cairncross Island: Walker (1991).

Malaisia scandens (Lour.) Planch.

Bird Island: Buckley 5177; Three Isles: Stoddart 4512; Turtle I Island: Buckley 3582; Turtle II Island: Buckley 3654, 4986; Turtle VI Island: Buckley 3510; Two Isles: Stoddart 4626 4654; West Cairncross Island: Walker (1991).

MORINGACEAE

Moringa oleifera Lam.

Pipon Island: Heatwole, s.n., Stoddart 4887.

MYOPORACEAE

Myoporum acuminatum R. Br. Cribb and Cribb 1985, 159

Bewick Island: Stoddart 4094; Howick Island: Heatwole, s.n., Stoddart 4858; Ingram Island: Buckley 3727, 3738, Stoddart 4043, 4064; Newton Island: Stoddart 4143; Nymph Island: Stoddart, sight; Sinclair Island: Stoddart 4186; Turtle I Island: Stoddart 4671; Turtle II Island: Buckley 3378; Turtle V Island: Buckley 3534, 3541, Stoddart, sight; Turtle VI Island: Buckley 3485; Two Isles: Stoddart 4609.

MYRISTICACEAE

Myristica insipida R. Br.

Green Island: Cairns City Council (1933) [as *Myristica insipidia*], Smith, Specht and Clapham (1973).

MYRSINACEAE

Aegiceras corniculatum Blanco Cribb and Cribb 1985,222-223,274

Baird III Island: Buckley 3831; Low Isles: Stoddart 4318; Morris Island: Buckley 3706.

MYRTACEAE

Eugenia carissoides F. v. M. Cribb and Cribb 1985, 160 (as *E. reinwardtiana*)

Bushy Island: Buckley 5229, 5232; Dalrymple Island: Walker, s.n.; Green Island: Specht list; Halfway Island: Buckley 3877b; MacArthur Island: Buckley 3850, 5184; Turtle I Island: Buckley 3570, 3611, Stoddart 4683; Turtle V Island: Buckley 3528; Turtle VI Island: Buckley 3505; Two Isles: Stoddart 4655; West Cairncross Island: Heatwole, s.n.

Eugenia rariflora Benth. ?

Green Island: Fosberg 61529.

Eugenia reinwardtiana (Bl.) DC.

West Cairncross Island: Walker (1991).

Eugenia suborbicularis Benth.

Turtle I Island: Buckley 3574, 3614; Turtle II Island: Buckley 3407.

Osbornia octodonta F. v. M. Cribb and Cribb 1985, 224

Beanley Island: Stoddart, sight; Bewick Island: Thom [as Stoddart 4165], Stoddart 4090; Binstead Island: Stoddart, sight; Chapman Island: Stoddart 5044; Coquet Island: Stoddart, sight; East Pethebridge Island: Stoddart 4764; Fisher Island: Stoddart 5105; Hannah Island: Heatwole, s.n.; Hannibal Island: Heatwole, s.n.; Houghton Island: Stoddart, sight; Howick Island: Heatwole, s.n., Stoddart 4199; Leggatt Island: Buckley 5007, Stoddart, sight; Low Isles: Stoddart 4337; Low Wooded Island: Stoddart 4525; Lowrie Island: Stoddart 4997; Morris Island: Stoddart, sight; Newton Island: Stoddart 4153; Nymph Island: Stoddart, sight; Pipon Island: Stoddart 4901; Three Isles: Stephenson et al. (1931), Stoddart 4514; Turtle I Island: Buckley 3603, Stoddart 4703; Turtle II Island: Buckley 3646, Stoddart, sight; Turtle III Island: Buckley 3563, Stoddart 4748; Turtle IV Island: Buckley 3567, Stoddart, sight; Turtle V Island: Buckley 3544; Turtle VI Island: Buckley 3484, Stoddart, sight; Two Isles: Stoddart 4631; Watson Island: Stoddart 4104; West Hope Island: Stoddart 4404; West Pethebridge Island: Stoddart 4788.

Syzygium rubiginosum Merr. & Perry

Green Island: Smith, Specht and Clapham (1973); Three Isles: MacGillivray (1852, I, pp. 105-106) [as *Calyptranthus*].

NYCTAGINACEAE

Boerhavia cf. *acutifolia* (Choisy) J. W. Moore
Boerhavia dominii

Eagle Island: Stoddart 4814; Low Wooded Island: Stoddart 4563; Newton Island: Stoddart 4128; Saunders Island: Stoddart 5086a; Two Isles: Stoddart 4619.

Boerhavia chinensis L.

Fife Island: Stoddart 4955; Pelican Island: Stoddart 4926; Pipon Island: Stoddart 4877.

Boerhavia coccinea Mill. (?)

Arden Island: Walker (1991); Dalrymple Island: Walker, s.n.; Dove Island: Walker, s.n.; Fife Island: Chaloupka and Godwin (1985); Stainer Island: Chaloupka and Godwin (1985).

Boerhavia fistulosa Fosb. var. *fistulosa*

Coombe Island: Stoddart 4021; East Pethebridge Island: Stoddart 4426; Michaelmas Cay: Stoddart 4215; Stapleton Island: Stoddart 4007; Three Isles: Stoddart 4521; Turtle III Island: Stoddart 4750; West Hope Island: Stoddart 4394; West Pethebridge Island: Stoddart 4782.

Boerhavia fistulosa Fosb. var. *puberuliflora* Fosb.

East Hope Island: Stoddart 4426; Fife Island: Stoddart 4954; Morris Island: Stoddart 4984; Saunders Island: Stoddart 5086b; Sinclair Island: Stoddart 4187; Stainer Island: Stoddart 4916.

Boerhavia mutabilis R. Br.

Coombe Island: Stoddart 4030; Nymph Island: Heatwole 136(?); Turtle I Island: Stoddart 4666.

Boerhavia repens L. (sensu lato)

Fife Island: Chaloupka and Godwin (1985); Green Island: Specht list.

Boerhavia tetrandra sensu Walker non Forst. f.

Arden Island, Douglas Island, Masig Island, Wallace Island, West Cairncross Island, West Hannibal Island, West Hope Island (all records under this name by Walker 1991); Cholmondeley Island: King et al. (1989a); Raine Island: Hacker (1990); Magra Island: King (1989); Wallace Island: King et al. (1989b).

Boerhavia spp.

Bird Island: Heatwole 131; Chapman Island: Heatwole, s.n.; Eagle Island: Heatwole, s.n.; Green Island: Specht list; Hannah Island: Heatwole, s.n.; Hannibal Island: Heatwole, s.n.; Howick Island: Heatwole, s.n.; Pipon Island: Heatwole, s.n.; Saunders Island: King and Limpus (1989); Stainer Island: Chaloupka and Godwin (1985); Three Isles: Heatwole, s.n.; West Cairncross Island: Heatwole, s.n.; Wharton Island: Heatwole, s.n. [These are specimens which we have not seen, determined by the collector as *Boerhavia diffusa* L., which we consider not to occur in Australia].

Pisonia grandis R. Br. Cribb and Cribb 1985, 164-168

Bird Island: Stoddart, sight; Cairncross Island: MacGillivray (1852, I, p. 120); Douglas Island: Buckley 5244, 5251; Douglas Island: Walker (1991); Dove Island: Walker (1991); East Hannibal Island: Walker (1991); Hannibal Island: Heatwole, s.n., Walker, sight; Masig Island: Walker (1991); Wallace Island: Buckley 3868, 5204, King et al. (1989b), Walker (1991); West Cairncross Island: Heatwole, s.n., Walker (1991); West Hannibal Island: Walker (1991); West Hope Island: Stoddart 4391, Walker (1991).

OLACACEAE

Olax pendula L.S. Smith

Hannibal Island: Heatwole, s.n.; West Cairncross Island: Heatwole, s.n., Walker (1991); West Hannibal Island: Walker (1991).

OLEACEAE

Jasminum aemulum R. Br. Cribb and Cribb 1985, 170

Green Island: Specht list, Stoddart 4280; Turtle I Island: Buckley 3578; Turtle II Island: Buckley 3430, 3662.

Jasminum didymum Forst.

Green Island: Smith, Specht and Clapham (1973); Ingram Island: Stoddart 4079.

Jasminum simplicifolium Forst. f.

Low Isles: Stephenson et al. (1931); Fosberg 55029.

Jasminum volubile Jacq.

Turtle I Island: Stoddart 4726; Turtle II Island: Buckley 3638.

Jasminum sp.

Green Island: Fosberg 61538.

Linociera ramiflora DC.

Green Island: Smith, Specht and Clapham (1973), Stoddart 4284; Low Isles: Stoddart 4324.

OPILIACEAE

Cansjera leptostachya Benth.

Green Island: Specht list; West Cairncross Island: Heatwole, s.n., Walker (1991).

Opilia amentacea Roxb.

West Cairncross Island: Heatwole, s.n., Walker (1991).

ORCHIDACEAE

Dendrobium discolor Lindl. Cribb and Cribb 1985, 172

Low Isles: Stoddart 4354; Low Wooded Island: Stoddart 4538; Turtle I Island: Stoddart 4691, Buckley 3616.

Orchidaceae indet.

Turtle I Island: Buckley 3617.

PANDANACEAE

Pandanus tectorius Parkinson Cribb and Cribb 1985, 173-176, 275
Pandanus adscendens St John
Pandanus oblatiapicalis St John
Pandanus pedunculatus R. Br.
Pandanus sinuvadosus St John
Pandanus viridinsularis St John

Arden Island: Walker (1991); Dalrymple Island: Walker, s.n.; Dove Island: Walker (1991); Green Island: Cairns City Council (1933) [as *Pandanus pedunculatus*], Smith, Specht and Clapham (1973), Stone (1982), St John 26266, 26269 in St John (1967, p. 527) [as *Pandanus adscendens*], St John 26267 in St John (1962, p. 310) [as *Pandanus oblatiapicalis*], St John 26268 in St John (1962, p. 329) [as *Pandanus sinuvadosus*], St John 26270 in St John (1962, p. 339)[as *Pandanus viridinsularis*], Stoddart 4256; Low Wooded Island: Stoddart 4539; Masig Island: Walker (1991); Pipon Island: Heatwole, s.n. [as *Pandanus* sp.]; Three Isles: Stephenson et al. (1931), Stoddart 4522; Two Isles: Stoddart, sight; West Cairncross Island: Heatwole, s.n. [as *Pandanus* sp.], Walker (1991); West Hope Island: Steers (1938, p. 73), Stoddart 4417, Walker (1991).

PASSIFLORACEAE

Passiflora foetida L. Cribb and Cribb 1985, 177

Green Island: Specht list; Stoddart 4265; Hannibal Island: Heatwole, s.n.; King Island: Walker, sight; Howick Island: Heatwole, s.n.; Low Isles: Stephenson et al. (1931), Fosberg 55036, Heatwole, s.n., Stoddart 4308; Low Wooded Island: Stoddart 4554; Masig Island: Walker (1991); Morris Island: Stoddart 4983; Nymph Island: Heatwole 146, Stoddart, sight; Pipon Island: Heatwole, s.n., Stoddart 4882; Turtle I Island: Buckley 3594, Stoddart 4719; West Hannibal Island: Walker (1991).

Passiflora herbertiana Lindl.

Green Island: Cairns City Council (1933).

PEDALIACEAE

Josephinia imperatricis Vent.

Arden Island: Walker (1991); Dalrymple Island: Walker, s.n.; Dove Island: Walker (1991); Fife Island: Steers (1938) [as *Josephinia grandiflora*], Buckley 5031; Howick Island: Mueller in Bailey, Fl. Qd., p. 1140 [as 'Howick's Group']; Low Isles: R. Brown and Henne in Bailey, Fl. Qd., p. 1140 [as *Josephinia grandiflora*]; Magra Island: Stoddart, sight; Masig Island: Walker (1991); Morris Island: Buckley 3786, Stoddart 4981; Pelican Island: A. Cunningham in Bailey, Fl. Qd., p. 1140; ; Saunders Island: Stoddart 5070; Three Isles: MacGillivray (1852, I, pp. 105-106), MacGillivray in Bailey, Fl. Qd., p. 1140, Stephenson et al. (1931) [all as *Josephinia grandiflora*], Stoddart 4467; West Cairncross Island: Walker (1991).

PHYTOLACCACEAE

Rivina humilis L.

Green Island: Gardner (1973), Specht list.

PLUMBAGINACEAE

Aegialitis annulata R. Br. Cribb and Cribb 1985, 225

Beanley Island: Stoddart, sight; Bewick Island: Thom [as Stoddart 4164]; Binstead Island: Stoddart 5014 (collection lost); Chapman Island: Heatwole, s.n., Stoddart 5045; Coquet Island: Stoddart, sight; East Cairncross Island: Heatwole, s.n.; East Pethebridge Island: Stoddart 4768; Fisher Island: Stoddart 5101; Hannah Island: Heatwole, s.n.; Hannibal Island: Mueller in Bailey, Fl. Qd., p. 943 [as 'Howick's Group'], Heatwole, s.n., Stoddart 4202; Leggatt Island: Stoddart, sight; Low Isles: Stephenson et al. (1931), Stoddart 4338; Low Wooded Island: Stoddart 4526; Lowrie Island: Buckley 5051, Stoddart 4991; Morris Island: Stoddart, sight; Newton Island: Stoddart 4148; Nymph Island: Heatwole 126, Stoddart, sight; Pipon Island: Stoddart 4902; Sand Island: Stoddart 4208; Sherrard Island: Stoddart, sight; Three Isles: Stoddart 4498; Turtle I Island: Stoddart 4701, 4702; Turtle II Island: Buckley 4984, 4985; Stoddart, sight; Turtle III Island: Stoddart 4746; Turtle IV Island: Stoddart, sight; Turtle V Island: Buckley 3526, Stoddart, sight; Turtle VI Island: Buckley 3483, Stoddart, sight; Two Isles: Stoddart 4646; Watson Island: Stoddart 4107; West Hope Island: Stoddart 4382; West Pethebridge Island: Stoddart 4777; Wharton Island: Heatwole, s.n.

POACEAE (GRAMINEAE)

Cenchrus echinatus L. Cribb and Cribb 1985, 179-180

Bramble Cay: Queensland Herbarium, s.n. (in Walker 1988); Coombe Island: Buckley 3754, Stoddart 4026; Coquet Island: Walker, sight; Eagle Island: Buckley 3443; East Hope Island: Stoddart 4436; Green Island: Specht list, Stoddart 4221; Masig Island: Walker (1991); Stapleton Island: Stoddart 4008.

Cenchrus cf. elymoides F. v. M.

Akone Island: Buckley 3908.

Cymbopogon refractus (R. Br.) Camus

Green Island: Specht list.

Cynodon dactylon (L.) Pers.

Bird Island: Heatwole 32.

Dactyloctenium aegyptium (L.) Willd.

Akone Island: Buckley 3909b; Green Island: Stoddart 4288b; Halfway Island; Hannibal Island: Heatwole, s.n.; Raine Island: Hacker (1990); West Cairncross Island: Heatwole, s.n., Walker (1991); West Hannibal Island: Walker (1991).

Dactyloctenium australe Steud.

Chapman Island: Heatwole, s.n.; Coombe Island: Stoddart 4015; Saunders Island: Buckley 3845; Stapleton Island: Stoddart 4001.

Digitaria ctenantha (F. v. M.) Hughes

Newton Island: Stoddart 4126b; Stainer Island: Buckley 3762b; Turtle II Island: Buckley 3371, 3664; Turtle V Island: Buckley 3482; West Hope Island: Walker (1991).

Digitaria sp.

Green Island: Specht list, Stoddart 4277 (sterile).

Eleusine indica (L.) Gaertn. Cribb and Cribb 1985, 180

Green Island: Specht list, Stoddart 4222, 4288a; Masig Island: Walker (1991); Raine Island: Stoddart 5061, Hacker (1990).

Eragrostis cumingii Steud.

Ingram Island: Buckley 3748a; Turtle I Island: Buckley 3589; reported by Lazarides from the Great Barrier Reef, island not listed.

Eragrostis sororia Domin

Farmer Island: Buckley 3825b.

Eragrostis sp.

Hannibal Island: Heatwole, s.n.; Little Boydong: Buckley 3844, 3867.

Heteropogon contortus (L.) R. & S.

Howick Island: Heatwole, s.n., Stoddart 4841; Three Isles: Heatwole, s.n.

Heteropogon triticeus (R. Br.) Stapf ex Craig

Bewick Island: Stoddart 4100; Howick Island: Mueller in Bailey, Fl. Qd., p. 1861 [as 'Howick's Group'] [as *Heteropogon insignis* Thur.].

Imperata cylindrica var. *major* (Nees) Hubb.

Dove Island: Walker (1991); Green Island: Cairns City Council (1933) [as *Imperata arundinacea*], Specht list; Masig Island: Walker (1991); Morris Island: Buckley 3787, Stoddart 4987; Three Isles: Heatwole, s.n.

Lepturus repens (Forst. f.) R. Br. Cribb and Cribb 1985, 180-181

Arden Island: Walker (1991); Beanley Island: Stoddart, sight; Binstead Island: Stoddart 5003 (collection lost); Bird Island: Denham in Bailey, Fl. Qd., p. 1919, Heatwole 30; Bramble Cay: Queensland Herbarium (in Walker 1988), Parmeter, s.n.; Bushy Island: Walker (1991); Chapman Island: Heatwole, s.n., Stoddart, sight; Coombe Island: Stoddart 4013; Douglas Island: Walker (1991); Dove Island: Walker (1991); East Cairncross Island: Heatwole, s.n., Walker (1991); East Hope Island: Stoddart 4425, 4448; Eagle Island: Smith and Buckley (1986); Farmer Island: Stoddart , sight; Fife Island: Heatwole, s.n., Stoddart 4959; Green Island: Specht list, Stoddart 4254; Hannah Island: Heatwole, s.n.; Hannibal Island: Heatwole, s.n.; Houghton Island: Stoddart, sight; Howick Island: Heatwole, s.n.; Low Isles: Stephenson et al. (1931),

Heatwole, s.n., Stoddart 4305; Low Wooded Island: Stoddart 4564; Lowrie Island: Stoddart 4999; Magra Island: Stoddart, sight, King (1989); Masig Island: Walker (1991); Michaelmas Cay: Stoddart 4217; Newton Island: Stoddart 4217; Nymph Island: Heatwole 139(?), Stoddart, sight; Pelican Island: Stoddart 4918; Pipon Island: Heatwole, s.n.; Raine Island: H.M.S. Challenger collection in Bailey, Fl. Qd., p. 1919, Stoddart 5051, 5059, Hacker (1990); Saunders Island: Stoddart 5066, King and Limpus (1989); Sinclair Island: Stoddart 4174; Stainer Island: Stoddart 4913, Chaloupka and Godwin (1985); Stapleton Island: Stoddart 4011; Three Isles: Heatwole, s.n.; Turtle I Island: Stoddart 4676; Turtle IV Island: Stoddart, sight; Turtle V Island: Stoddart, sight; Turtle VI Island: Stoddart, sight; Two Isles: Stoddart 4647; Wallace Island: King et al. (1989b); Walker (1991); West Cairncross Island: Heatwole, s.n., Walker (1991); West Hannibal Island: Walker (1991); West Hope Island: Stoddart 4453, Walker (1991); Wharton Island: Heatwole, s.n.

Lepturus stoddartii Fosberg

Eagle Island: Stoddart 4832; Ingram Island: Stoddart 4082, 4282; Low Isles: Fosberg 55044; Turtle II Island: Buckley 3399; Turtle III Island: Stoddart 4749; Turtle V Island: Buckley 3394.

Lepturus sp.

Turtle VI Island: Buckley 3518(?) (sterile).

Panicum antidotale Retz.

Three Isles: Heatwole, s.n.

Panicum maximum Jacq.

Three Isles: Stoddart 4480, 4584.

Panicum miliiforme Presl

Buchan Island: Buckley 3843; Chapman Island: Heatwole, s.n.; Low Isles, Heatwole, s.n.; Wallace Island: Buckley 3870.

Panicum muticum Forssk.

Stainer Island: Buckley 3762a.

Panicum trichoides Sw.

Douglas Island: Buckley 3890, Walker (1991); East Cairncross Island: Heatwole, s.n.; Hannibal Island: Heatwole, s.n.; West Cairncross Island: Heatwole, s.n.

Spinifex hirsutus Labill. Cribb and Cribb 1985, 181-182

Bushy Island: Buckley 5240; Cholmondeley Island: King et al. (1989a); Farmer Island: Stoddart, sight; Green Island: Smith, Specht and Clapham (1973); Hannibal Island: Heatwole, s.n.; Magra Island: Stoddart, sight, King (1989); Saunders Island: Stoddart 5062, King and Limpus (1989); Wallace Island: King et al. (1989b).

Spinifex longifolius R. Br.

Farmer Island: Buckley 3814; Milman Island: Buckley 3897.

Spinifex sericea R. Br.

Masig Island: Walker (1991); Wallace Island: Walker (1991); West Hope Island: Walker (1991).

Sporobolus virginicus (L.) Kunth Cribb and Cribb 1985, 182-183

Akone Island: Buckley 3909a(?); Arden Island: Walker (1991); Beanley Island: Stoddart, sight; Bewick Island: Stoddart 4191; Cholmondeley Island: Buckley 5208; Coombe Island: Stoddart 4014; Dalrymple Island: Walker, s.n.; Douglas Island: Walker (1991); Dove Island: Walker (1991); Eagle Island: Stoddart 4808; East Hope Island: Stoddart 4427; East Pethebridge Island: Stoddart 4770; Eagle Island: Smith and Buckley (1986); Farmer Island: Stoddart, sight; Fife Island: Buckley 5030, Stoddart 4958, Chaloupka and Godwin (1985); Green Island: Specht list, Stoddart 4266; Ingram Island: Stoddart 4071; Kay Island: Stoddart 5096; Leggatt Island: Buckley 3715, 5005, Stoddart, sight; Low Isles: Fosberg 55024, Heatwole, s.n., Stoddart 4348; Magra Island: Stoddart, sight; Masig Island: Walker (1991); Michaelmas Cay: Stoddart 4213; Morris Island: Stoddart 4977; Newton Island: Stoddart 4139; Nymph Island: Heatwole 132; Pelican Island: Stoddart 4920; Pipon Island: Heatwole, s.n., Stoddart 4870; Saunders Island: Stoddart 5069; Sherrard Island: Stoddart 5036 (collection lost); Stapleton Island: Stoddart 4006; Tern Island: Buckley 5269; Three Isles: Heatwole, s.n., Stoddart 4500; Turtle II Island: Buckley 3369, 3370 [var. *minor*]; Turtle III Island: Buckley 3554, Stoddart 4278; Turtle V Island: Buckley 3529; Two Isles: Stoddart 4648; Upolu Cay: Stoddart 4218; West Cairncross Island: Heatwole, s.n., Walker (1991); West Hope Island: Stoddart 4456, Walker (1991); West Pethebridge Island: Stoddart 4779.

Stenotaphrum micranthum (Desv.) Hubb. Cribb and Cribb 1985, 183-184

Bird Island: Heatwole 29; Green Island: Smith, Specht and Clapham (1973), Roe 1047.

Themeda arguens Hack.

Hannah Island: Heatwole, s.n.; Hay Island: Buckley 3775; Ingram Island: Buckley 3752, Stoddart 4078; Turtle I Island: Buckley 3590, Stoddart 4673; Turtle II Island: Buckley 3372.

Thuarea involuta (Forst. f.) R. Br. ex R. & S. Cribb and Cribb 1985, 184-185

Arden Island: Walker (1991); Coombe Island: Stoddart 4032; Dalrymple Island: Walker, s.n.; Eagle Island: Heatwole, s.n., Stoddart 4809, Smith and Buckley (1986); East Hope Island: Stoddart 4443; Fife Island: Heatwole, s.n., Chaloupka and Godwin (1985); Green Island: Smith, Specht and Clapham (1973), Fosberg 61519, Stoddart 4251; Ingram Island: Stoddart 4067; Low Wooded Island: Stoddart 4574; Masig Island: Walker (1991); Three Isles: Stoddart 4506; Two Isles: Stoddart 4593; West Cairncross Island: Walker (1991); West Hope Island: Walker (1991).

Tricholaena rosea Nees
Rhynchelytrum repens sensu auct. non (Willd.) Hubb.

Low Isles: Fosberg 55025, Heatwole, s.n., Stoddart 4356; Masig Island: Walker (1991) [as *Rhynchelytrum repens*].

Poaceae indet.

Bramble Cay: Walker (1988)

PODOCARPACEAE

Podocarpus neriifolius D. Don

Green Island: Specht list.

Podocarpus sp.

Green Island: Smith, Specht and Clapham (1973).

POLYPODIACEAE

Drynaria quericifolia (L.) J. Sm.

Turtle I Island: Buckley 3603, Stoddart 4718.

Drynaria rigidula (Sw.) Bedd.

Low Isles: Stoddart 4343; West Hope Island: Walker (1991).

Nephrolepis biserrata (Sw.) Schott ?
Nephrolepis hirsutula sensu auct. non (Forst. f.) Presl

Green Island: Specht list, Stoddart 4271.

Platycerium bifurcatum (Cav.) C. Chr.

Low Isles: Stoddart 4357; West Hope Island: Walker (1991).

PORTULACACEAE

Portulaca australis Endl.

Arden Island: Walker (1991); Arnold Island: Buckley 5261; Chapman Island: Heatwole, s.n.; Eagle Island: Stoddart 4834; Dove Island: Walker (1991); East Cairncross Island: Heatwole, s.n.; Magra Island: Stoddart, sight; Morris Island: Buckley 3792(?), Stoddart, sight; Pipon Island: Stoddart 4884; Turtle I Island: Stoddart 4665; Turtle II Island: Buckley 3405; Turtle V Island: Buckley 3532; Two Isles: Stoddart 4649; West Cairncross Island: Heatwole, s.n.; West Hannibal Island: Walker (1991); West Hope Island: Walker (1991).

Portulaca oleracea L. Cribb and Cribb 1985, 186

Bramble Cay: Parmeter, s.n., Walker, s.n.; Bird Island: Heatwole 27 or 28; Buchan Island: Buckley 3840; Bushy Island: Walker (1991); Dalrymple Island: Walker, s.n.; Dove Island: Walker, s.n.; Fisher Island: Buckley 3827b; Magra Island: King (1989); Raine Island: Hacker (1990); Stapleton Island: Buckley 3755; Wallace Island: King et al. (1989b), Walker (1991).

Portulaca sp.

Bird Island: Heatwole, s.n.; Ingram Island: Buckley 3730; Lowrie Island: Buckley 5049.

RHAMNACEAE

Colubrina asiatica (L.) Brong. Cribb and Cribb 1985, 187

Arden Island: Walker (1991); Bewick Island: Stoddart 4098; Dalrymple Island: Walker (1991); Dove Island: Walker, s.n.; East Hope Island: Stoddart 4442; Fife Island: Heatwole, s.n., Stoddart 4947, Chaloupka and Godwin (1985); Green Island: Smith, Specht and Clapham (1973), Fosberg 61508, Stoddart 4236; Hannibal Island: Heatwole, s.n.; Howick Island: Mueller in Bailey, Fl. Qd., p. 270 [as 'Howick's Group'], Heatwole, s.n., Stoddart 4855; Ingram Island: Stoddart 4063; Low Isles: Fosberg 55028, Heatwole, s.n., Stoddart 4353; Low Wooded Island: Stoddart 4561; Masig Island: Walker (1991); Morris Island: Buckley 3711, Stoddart 4967; Newton Island: Stoddart

4132; Nymph Island: Heatwole 129, Stoddart, sight; Pipon Island: Heatwole, s.n., Stoddart 4880; Saunders Island: Stoddart 5078; Sherrard Island: Stoddart, sight; Sinclair Island: Stoddart 4175; Three Isles: Heatwole, s.n., Stoddart 4471; Turtle II Island: Buckley 3414, 3651; Turtle III Island: Stoddart 4755; Turtle V Island: Buckley 3383, 3551, Stoddart, sight; Two Isles: Stoddart 4617; Watson Island: Stoddart 4105; West Cairncross Island: Walker (1991); West Hannibal Island: Walker (1991); West Hope Island: Stoddart 4402, Walker (1991).

Schistocarpaea sp.

Green Island: Gardner (1973).

Ventilago sp.

Green Island: Specht list.

RHIZOPHORACEAE

Bruguiera cylindrica (L.) Bl.

Binstead Island: Buckley 3801(?); Fisher Island: Buckley 3829, 5084, 5088, Stoddart 5097; Pirie Island: Buckley 5193; Turtle I Island: Buckley 3596, Stoddart 4698.

Bruguiera exaristata Ding Hou

Chapman Island: Buckley 3810; East Pethebridge Island: Stoddart 4760; Fisher Island: Buckley 5086; Hannah Island: Heatwole, s.n.; Leggatt Island: Buckley 3719, 5013; Low Wooded Island: Stoddart 4528, 4537; Lowrie Island: Stoddart 4993; Nymph Island: Heatwole 120; South Bird Island: Buckley 5160; Turtle I Island: Buckley 3608; Turtle II Island: Buckley 3641a, Stoddart, sight; Two Isles: Stoddart 4635; West Hope Island: Stoddart 4387; West Pethebridge Island: Stoddart 4785.

Bruguiera gymnorhiza (L.) Lam. Cribb and Cribb 1985, 227-228, 276

Baird Island: Buckley 5105, 5108; Baird III Island: Buckley 3836; Bewick Island: Thom [as Stoddart 4162], Stoddart 4085; East Pethebridge Island: Stoddart 4763; Hannibal Island: Heatwole, s.n.; Howick Island: Stoddart 4198, 4204; Leggatt Island: Buckley 3720(?), 5008(?), 5014; Low Isles: Stephenson et al. (1931) [as *Bruguiera rheedii*], Stoddart 4315; Newton Island: Stoddart 4147a; Three Isles: Stoddart 4663; Turtle I Island: Stoddart 4826; Turtle II Island: Buckley 3433, Stoddart, sight; Two Isles: Stoddart 4641; West Hope Island: Stoddart 4406; West Pethebridge Island: Stoddart 4790.

Bruguiera sexangula (Lour.) Poir.

Watson Island: Stoddart 4110 [following A. McCusker, *Flora of Australia*, 22 (1984)].

Bruguiera sp.

Baird III Island: Buckley 3830; Buchan Island: Buckley 3841; Bushy Island: Buckley 3857; Leggatt Island: Buckley 3718; South Bird Island: Buckley 5162b.

Carallia brachiata (Lour.) Merr.
Carallia integerrima DC.

Green Island: Smith, Specht and Clapham (1973).

Ceriops tagal (Perr.) C.B. Rob. var. *australis* C. T. White
Cribb and Cribb 1985, 228-230, 276 (as *C. tagal*)

Low Wooded Island: Stoddart 4527, 4536; Lowrie Island: Stoddart 4992; Pipon Island: Stoddart 4903; West Pethebridge Island: Stoddart 4786.

Ceriops tagal (Perr.) C. B. Rob. var. *tagal*

Baird Island: Buckley 5106; Bewick Island: Thom [as Stoddart 4168, 4170, 4171, 4172], Stoddart 4086; Bushy Island: Buckley 3859; East Pethebridge Island: Stoddart 4761; Leggatt Island: Buckley 5012; Low Isles: Stephenson et al. (1931) [as *Ceriops tagal*], Stoddart 4317; Lowrie Island: Buckley 3795(?), 5033; Newton Island: Stoddart 4154; South Bird Island: Buckley 5162a; Three Isles: Stoddart 4510; Turtle I Island: Buckley 3605, Stoddart 4699; Turtle II Island: Buckley 3640; Two Isles: Stoddart 4634, 4637; Watson Island: Stoddart 4113; West Hope Island: Stoddart 4385, 4386; West Pethebridge Island: Stoddart 4787.

Rhizophora apiculata Bl.

Hay Island: Buckley 3778; Lance Island: Buckley 3758b (sterile).

Rhizophora lamarckii Montr.

Bushy Island: Buckley 3856(?).

Rhizophora mucronata var. *stylosa* (Griff.) Schimper
Cribb and Cribb 1985, 230-232, 277-278 (as *R. stylosa*)
Rhizophora stylosa Griff.

Beesley Island: Stoddart, sight; Bewick Island: Thom [as Stoddart 4160]; Binstead Island: Buckley 3805, Stoddart 5018 (collection lost); Bird Island: Stoddart, sight; Bushy Island: Buckley 3858; Chapman Island: Stoddart 5047; Dalrymple Island: Walker, s.n.; East Cairncross Island: Heatwole, s.n.; East Pethebridge Island: Stoddart 4766; Fisher Island: Buckley 3827a, 5090, Stoddart 5106; Hampton Island: Stoddart 4212; Hannah Island: Heatwole, s.n.; Hannibal Island: Heatwole, s.n.; Howick Island: Heatwole, s.n., Stoddart 4200, 4205, 4840; Ingram Island: Buckley 3749; Leggatt Island: Buckley 3713, 5006; Low Isles: Stephenson et al. (1931) [as *Rhizophora mucronata*], Stoddart 4339; Low Wooded Island: Stoddart 4523; Lowrie Island: Buckley 5050, Stoddart 4990; Morris Island: Buckley 3705; Newton Island: Stoddart 4146, 4149; Nymph Island: Heatwole 120, Stoddart, sight; Pipon Island: Heatwole, s.n., Stoddart 4881, King (1986) [as *Rhizophora stylosa*]; Sand Island: Stoddart, sight; Sherrard Island: Stoddart 5033 (collection lost); South Bird Island: Buckley 5166; Three Isles: Stephenson et al. (1931) [as *Rhizophora mucronata*], Heatwole, s.n., Stoddart 4497 (collection lost); Turtle I Island: Stoddart 4695; Turtle II Island: Buckley 3635, Stoddart, sight; Turtle III Island: Buckley 3557, Stoddart 4747; Turtle IV Island: Stoddart, sight; Turtle V Island: Stoddart, sight; Turtle VI Island: Stoddart, sight; Two Isles: Stoddart 4633; Watson Island: Stoddart 4108, 4110a; West Hope Island: Stoddart 4403; West Pethebridge Island: Stoddart 4789.

Rhizophora sp.

Turtle II Island: Buckley 3644; Wharton Island: Buckley 3759.

RUBIACEAE

Canthium coprosmoides F. v. M.

Turtle I Island: Buckley 3615; Turtle II Island: Buckley 3429, 3636; Turtle VI Island: Buckley 3509.

Canthium vacciniifolium F. v. M.

Cairncross Island: Mueller in Bailey, Fl. Qd., p. 764, Walker (1991).

Canthium sp. ?

Turtle I Island: Buckley 3573; Turtle VI Island: Buckley 3507.

Guettarda speciosa L. Cribb and Cribb 1985, 188-189, 279

Bewick Island: Stoddart, sight; Bird Island: Stoddart 5093; Coquet Island: Stoddart, sight; Eagle Island: Stoddart 4798; East Cairncross Island: Heatwole, s.n.; Green Island: Cairns City Council (1933), Specht list, Stoddart 4249; Hannibal Island: Heatwole, s.n.; Houghton Island: Stoddart, sight; Howick Island: Heatwole, s.n., Stoddart 4860; Ingram Island: Stoddart 4047; Leggatt Island: Stoddart, sight; Low Wooded Island: Stoddart 4558; Masig Island: Walker (1991); Nymph Island: Stoddart, sight; West Cairncross Island: Walker (1991); West Hannibal Island: Walker (1991); West Hope Island: Walker (1991).

Ixora klanderiana F. v. M.

Green Island: Smith, Specht and Clapham (1973), Fosberg 61534; Ingram Island: Buckley 5024; Nymph Island: Heatwole 143(?).

Mitracarpus hirtus (L.) DC.

Fife Island: Heatwole, s.n.; Hannah Island: Heatwole, s.n.; Howick Island: Heatwole, s.n. [The above records should be considered doubtful, as we have not seen the specimens].

Morinda citrifolia L.Cribb and Cribb 1985, 189-190

Bewick Island: Stoddart, sight; Dove Island: Walker (1991); Douglas Island: Walker (1991) (?); Green Island: Cairns City Council (1933), St John (1967), Smith, Specht and Clapham (1973), Stoddart 4275; Howick Island: Heatwole, s.n., Stoddart 4863; Low Isles: Stoddart 4316; Low Wooded Island: Stoddart 4530; Masig Island: Walker (1991); Milman Island: Buckley 3899 (reticulate?); Three Isles: Heatwole, s.n., Stoddart 4483; Two Isles: Stoddart 4608; West Hope Island: Stoddart 4399, Walker (1991).

Scyphiphora hydrophyllacea Gaertn.

Dove Island: Walker (1991).

Spermacoce buckleyi Fosb.

Fife Island: Steers (1938) (?), Stoddart 4956; Howick Island: Stoddart 4868; Ingram Island: Stoddart 4059; Newton Island: Stoddart 4130; Sinclair Island: Buckley 3701.

Spermacoce everistii Fosb.

Milman Island: Buckley 3896.

Spermacoce marginata Benth.

Fife Island: Chaloupka and Godwin (1985) [this may possibly be *Spermacoce buckleyi* Fosb.]; Howick Island: MacGillivray and Mueller in Bailey, Fl. Qd., [as 'Howick's Group'] [this may possibly be *Spermacoce buckleyi* Fosb.].

Spermacoce sp.

Dove Island: Walker (1991).

RUTACEAE

Citrus aurantiifolia (Christm.) Swingle

Low Isles: Fosberg 55055.

Clausena brevistyla Oliv.

East Hope Island: MacGillivray in Bailey, Fl. Qd., p. 213 [as 'Hope Islands'].

Flindersia ifflaiana F. v. M.

Green Island: Cairns City Council (1933).

Glycosmis pentaphylla Corr.

Douglas Island: Buckley 5260, Walker (1991); East Hope Island: Stoddart 4432; Green Island: Smith, Specht and Clapham (1973); Hannibal Island: Heatwole, s.n.; Howick Island: Stoddart 4866; Low Isles: Stoddart 4333; Turtle VI Island: Buckley 3513; West Cairncross Island: Heatwole, s.n., Walker (1991); West Hannibal Island: Walker (1991); West Hope Island: Walker (1991).

Micromelum minutum (Forst.) Leem.

Bewick Island: Stoddart 4097; Cairncross Island: Mueller in Bailey, Fl. Qd., p. 212 [as *Micromelum pubescens* Bl.]; Douglas Island: Buckley 3892, Walker (1991); East Hope Island: Stoddart 4430; Green Island: Specht list; Hannibal Island: Heatwole, s.n.; Howick Island: Heatwole, s.n., Stoddart 4859, 4867; Low Isles: Stoddart 4323; Nymph Island: Heatwole 123; Turtle I Island: Buckley 3604, Stoddart 4717; Turtle II Island: Buckley 3409, 3657, 4982; West Cairncross Island: Heatwole, s.n., Walker (1991); West Hannibal Island: Walker (1991).

SANTALACEAE

Exocarpos latifolius R. Br.

Bewick Island: Stoddart 4087; Bird Island: Buckley 5173; East Cairncross Island: Heatwole, s.n.; Farmer Island: Buckley 5104; Halfway Island: Buckley 3874, 3879, 5214; Hannibal Island: Heatwole, s.n.; Low Wooded Island: Stoddart 4552; Milman Island: Buckley 3900; Turtle I Island: Stoddart 4682; Turtle VI Island: Buckley 3488; West Cairncross Island: Heatwole, s.n., Walker (1991); West Hannibal Island: Walker (1991); West Hope Island: Stoddart 4458, Walker (1991).

SAPINDACEAE

Alectryon sp.

Turtle II Island: Buckley 3645.

Cupaniopsis anacardioides (A. Rich.) Radlk. Cribb and Cribb 1985, 194
Cupania anacardioides A. Rich.

Green Island: Smith, Specht and Clapham (1973); Hay Island: Buckley 3379.

Dodonaea platyptera F. v. M.

Hay Island: Buckley 3768.

Dodonaea viscosa L.

Green Island: Smith, Specht and Clapham (1973), Fosberg 61513; Hannah Island: Heatwole, s.n.; Masig Island: Walker (1991); West Cairncross Island: Heatwole, s.n., Walker (1991).

Ganophyllum falcatum Bl.

Farmer Island: Buckley 3813, 5102; Green Island: Smith, Specht and Clapham (1973), Stoddart 4290; Ingram Island: Stoddart 4054; Turtle I Island: Buckley 3600(?); Two Isles: Stoddart 4621; West Cairncross Island: Heatwole, s.n., Walker (1991); West Hope Island: Walker (1991).

SAPOTACEAE

Manilkara kauki Dubard

Aplin Island: Buckley 3902; Arden Island: Walker (1991); Baird Island: Buckley 5111; Baird III Island: Buckley 3833; Bewick Island: Stoddart 4091;

Bird Island: Buckley 5168, 5178; Bushy Island: Buckley 5233; Cairncross Island: A. Cunningham in King (1827, I, p. 383) [as *Mimusops kauki*]; Dalrymple Island: Walker, s.n.; Dove Island: Walker (1991); Douglas Island: Buckley 5242, Walker (1991); East Cairncross Island: Heatwole, s.n.; Farmer Island: Buckley 5103a; Halfway Island: Buckley 3876; Hannibal Island: Heatwole, s.n.; Ingram Island: Buckley 3732, Stoddart 4056; Leggatt Island: Buckley 3722b; Little Boydong: Buckley 5199; Low Wooded Island: Stoddart 4550; MacArthur Island: Buckley 3848, 5190; Masig Island: Walker (1991); Newton Island: Stoddart, sight; Nymph Island: Heatwole 118; Pipon Island: Heatwole, s.n., Stoddart 4875; Pirie Island: Buckley 5191; Three Isles: MacGillivray (1852, I, pp. 105-106) [as *Mimusops kauki*], Stoddart 4518; Turtle I Island: Buckley 3609 (collection lost), Stoddart 4681; Turtle II Island: Buckley 3428, 4981; Two Isles: MacGillivray (1852, I, p. 107) [as *Mimusops kauki*], Stoddart 4628; Wallace Island: Buckley 5205, 5206, King et al. (1989b), Walker (1991); West Cairncross Island: Walker (1991); West Hannibal Island: Walker (1991).

Mimusops elengi L. — Cribb and Cribb 1985, 195

Eagle Island: Buckley 3448; East Hope Island: Stoddart 4423; Fife Island: MacGillivray (1852, I, p. 114) [as *Mimusops*], Heatwole, s.n.; Green Island: St John (1962) [as *Mimusops parviflora*], Smith, Specht and Clapham (1973); Hay Island: Buckley 3780; Howick Island: Mueller in Bailey, Fl. Qd., p. 961 [as 'Howick's Group'] [as *Mimusops browniana* Benth.]; Ingram Island: Buckley 3743, 5020, 5022, Stoddart 4073; Low Isles: Stoddart 4335, 4365.; Nymph Island: Heatwole 144; Turtle II Island: Buckley 3650; West Hope Island: Stoddart 4400, 4413, Walker (1991).

Pouteria obovata (R. Br.) Baehni — Cribb and Cribb 1985, 196
Planchonella obovata (R. Br.) Pierre

Eagle Island: Heatwole, s.n., Stoddart 4801; East Hope Island: Stoddart 4446; Green Island: Cairns City Council (1933) [as *Sideroxylon obovatum*], St John (1962) [as *Planchonella obovata*], Smith, Specht and Clapham (1973) [as *Planchonella obovata*], Fosberg 61525, 61527, Stoddart 4267, 4282; Howick Island: Stoddart 4843; Ingram Island: Buckley 3728, 3745, 5026, 5027; Low Isles: Heatwole, s.n., Stoddart 4358, 4366; Nymph Island: Heatwole 135; South Bird Island: Buckley 3928; Tern Island: Buckley 5266; Three Isles: Heatwole, s.n.; Turtle VI Island: Buckley 3508; Two Isles: Stoddart 4597.

Pouteria pohlmaniana (F. v. M.) Baehni

Farmer Island: Buckley 3826.

Pouteria sericea (R. Br.) Baehni — Cribb and Cribb 1985, 196-197

Eagle Island: Buckley 3447.

'Sideroxylon argenteum Spreng.'

Howick Island: Mueller in Bailey, Fl. Qd., p. 958 [as 'Howick's Group'].

SOLANACEAE

Capsicum frutescens L.

Hannibal Island: Heatwole, s.n. (probably).

Physalis angulata L.
Physalis minima sensu auct. non L.

Low Isles: Stoddart 4350.

Physalis sp.

Little Boydong: Buckley 5198(?).

Solanum seaforthianum

West Hope Island: Walker (1991).

Solanum torvum Sw.

West Hope Island: Walker (1991).

Solanum viridifolium Dunal
Solanum viride R. Br.

Arden Island: Walker (1991); Dalrymple Island: Walker, s.n.; East Hannibal Island: Walker (1991); Fife Island: Steers (1938), Heatwole, s.n., Buckley 3784, Chaloupka and Godwin (1985); Hannibal Island: Heatwole, s.n.

Solanum sp.

West Hope Island: Walker (1991).

SONNERATIACEAE

Sonneratia alba J. Sm. Cribb and Cribb 1985, 234

Arnold Island: Buckley 5262; Baird Island: Buckley 5107, 5109; Bewick Island: Stoddart 4161, 4167; Binstead Island: Buckley 3804, Stoddart 5019 (collection

lost); Chapman Island: Buckley 5070, Stoddart 5043; Fisher Island: Stoddart 5104; Howick Island: Stoddart 4201, 4839, 4852; Morris Island: Buckley 3707(?); Pipon Island: Stoddart 4905; Three Isles: Stoddart 4664; Turtle V Island: Buckley 3521; Two Isles: Stoddart 4640; West Pethebridge Island: Stoddart 4773.

STERCULIACEAE

Sterculia quadrifida R. Br.

Green Island: Specht list, Stoddart 4289; Low Wooded Island: Stoddart 4585.;

SURIANACEAE

Suriana maritima L. Cribb and Cribb 1985, 199

Arden Island: Walker (1991); Beanley Island: Stoddart, sight; Bewick Island: Stoddart 4089; Bird Island: Stoddart, sight; Coombe Island: Stoddart 4020; Dalrymple Island: Walker, s.n.; Douglas Island: Walker (1991); Dove Island: Walker (1991); Eagle Island: MacGillivray (1852, I, p. 109), Heatwole, s.n., Stoddart 4810, Smith and Buckley (1986); East Cairncross Island: Heatwole, s.n.; Fife Island: Chaloupka and Godwin (1985); Hannibal Island: Heatwole, s.n.; Houghton Island: Stoddart, sight; Howick Island: Heatwole, s.n., Stoddart 4850; Ingram Island: Stoddart 4058; King Island: Walker, sight; Low Wooded Island: Stoddart 4529; Magra Island: Stoddart, sight, King (1989); Morris Island: Stoddart 4973; Nymph Island: Heatwole 121, Stoddart, sight; Pipon Island: Heatwole, s.n., Stoddart 4871; Saunders Island: Stoddart 5082, King and Limpus (1989) [as *Suriana* sp.]; Sherrard Island: MacGillivray (1852, I, p. 116), Stoddart 5026 (collection lost); Three Isles: MacGillivray (1852, I, pp. 105-106), Heatwole, s.n., Stoddart 4469; Turtle II Island: Stoddart 4752; Turtle IV Island: Stoddart, sight; Turtle V Island: Stoddart, sight; Two Isles: Stoddart 4592; West Cairncross Island: Heatwole, s.n., Walker (1991).

TACCACEAE

Tacca leontopetaloides (L.) O. Ktze.

Arden Island: Walker (1991); Dalrymple Island: Walker, s.n.; Dove Island: Walker (1991); Green Island: Smith, Specht and Clapham (1973), Stoddart 4255; Masig Island: Walker (1991); Turtle II Island: Buckley 3423; West Cairncross Island: Walker (1991).

TILIACEAE

Grewia orientalis L.

Green Island: Specht list.

Grewia oxyphylla Burret

Fife Island: Buckley 3782; Low Wooded Island: Stoddart 4587.;

Triumfetta repens Merr. & Rolfe — Cribb and Cribb 1985, 211-201
Triumfetta procumbens sensu auct. non Forst. f.

Arden Island: Walker (1991); Eagle Island: Heatwole, s.n., Stoddart 4811; Green Island: Specht list; Howick Island: Bailey, Fl. Qd., p. 155 [as 'Howick Group'] [as *Triumfetta procumbens* Forst. f.]; Ingram Island: Buckley 3724; Turtle II Island: Buckley 3564; Two Isles: Stoddart 4639; Wallace Island: King et al. (1989b), Walker (1991); West Cairncross Island: Heatwole, s.n., Walker (1991).

Triumfetta rhomboidea Jacq.

Green Island: Specht list, Stoddart 4250.

ULMACEAE

Celtis paniculata (Endl.) Planch. — Cribb and Cribb 1985, 202

Bushy Island: Buckley 5221; Douglas Island: Walker (1991) (?); Farmer Island: Buckley 5100, 5101; Little Boydong: Buckley 3864, 5201; MacArthur Island: Buckley 3849, 3853; West Cairncross Island: Heatwole, s.n., Walker (1991); West Hope Island: Walker (1991).

Celtis philippinensis Blanco

Douglas Island: Buckley 3891, 5252; Turtle II Island: Buckley 3426, 3665.

Celtis sp.

Green Island: Fosberg 61531.

URTICACEAE

Pipturus argenteus (Forst. f.) Wedd.

Arden Island: Walker (1991); Green Island: Mauritzon in 1936 (S); Masig Island: Walker (1991).

VERBENACEAE

Clerodendrum inerme (L.) Gaertn. Cribb and Cribb 1985, 204-205

Arden Island: Walker (1991); Beesley Island: Stoddart, sight; Bushy Island: Buckley 5217; Chapman Island: Buckley 5069; Coombe Island: Stoddart 4019; Douglas Island: Walker (1991); Dove Island: Walker (1991); Eagle Island: MacGillivray (1852, I, p. 109), Heatwole, s.n., Buckley 3440(?), Stoddart 4806; East Cairncross Island: Heatwole, s.n.; East Hope Island: Stoddart 4441; Farmer Island: Stoddart, sight; Fife Island: Heatwole, s.n., Stoddart 4940 (collection lost), Chaloupka and Godwin (1985); Green Island: Gardner (1973), Specht list, Stoddart 4237; Hannibal Island: Heatwole, s.n.; Howick Island: Heatwole, s.n.; Low Isles: Stoddart 4334; Low Wooded Island: Stoddart 4571; Masig Island: Walker (1991); Morris Island: Stoddart 4965; Newton Island: Stoddart 4129; Pipon Island: Heatwole, s.n., Stoddart 4890; Saunders Island: Stoddart 5077; Three Isles: MacGillivray (1852, I, pp. 105-106), Stoddart 4507; Turtle I Island: Buckley 3195; Turtle II Island: Buckley 3646b; Turtle V Island: Buckley 3527; Two Isles: Stoddart 4645; West Cairncross Island: Heatwole, s.n., Walker (1991); West Hannibal Island: Walker (1991); West Hope Island: Walker (1991).

Clerodendrum sp.

Eagle Island: Heatwole, s.n.; East Cairncross Island: Heatwole, s.n.; Low Isles: Heatwole, s.n.; Lowrie Island: Stoddart 5002; Morris Island: MacGillivray (1852, I, p. 115); Three Isles: Heatwole, s.n.; West Cairncross Island: Heatwole, s.n.

Lantana camara L.

East Hope Island: Stoddart 4439; Low Isles: Fosberg 55046, Heatwole, s.n., Stoddart 4363; Masig Island: Walker (1991).

Premna serratifolia L. Cribb and Cribb 1985, 205 (as *P. corymbosa*)
Premna obtusifolia R. Br.
Premna corymbosa Burm. f.

Arden Island: Walker (1991); Bewick Island: Stoddart 4179; Dugong Island: Buckley 5277; Douglas Island: Walker (1991); Dove Island: Walker (1991); East Cairncross Island: Heatwole, s.n.; East Hope Island: Stoddart 4372; Fife Island: Heatwole, s.n., Stoddart 4951, Chaloupka and Godwin (1985); Green Island: Cairns City Council (1933) [as *Premna obtusifolia*], Smith, Specht and Clapham (1973), Fosberg 61518, Stoddart 4244; Hannah Island: Heatwole, s.n.; Hannibal Island: Heatwole, s.n.; Howick Island: Heatwole, s.n., Stoddart 4845; Ingram Island: Stoddart 4050; Low Isles: Stephenson et al. (1931) [as *Premna obtusifolia*], Tandy 538 (BM), Heatwole, s.n., Fosberg 55040; Low Wooded Island: Stoddart 4579; Lowrie Island: Buckley 5038(?); Masig Island: Walker (1991); Morris Island: MacGillivray (1852, I, p. 115) [as *Premna*], Buckley 3708; Newton Island: Stoddart 4138; Pelican Island: Stoddart 4928;

Saunders Island: Stoddart 5065; Three Isles: MacGillivray (1852, I, pp. 105-106) [as *Premna obtusifolia*], Stephenson 667 (BM), Heatwole, s.n., Stoddart 4479; Turtle I Island: Stoddart 4677; Turtle II Island: Buckley 3417, 3661; Turtle V Island: Buckley 3542; Turtle VI Island: Buckley 3516; Two Isles: Stoddart 4620; Watson Island: Stoddart 4114; West Cairncross Island: Heatwole, s.n., Walker (1991); West Hannibal Island: Walker (1991); West Hope Island: Stoddart 4416, Walker (1991).

Stachytarpheta jamaicensis (L.) Vahl — Cribb and Cribb 1985, 205-206

Bewick Island: Stoddart 4084; Eagle Island: Stoddart 4833; Green Island: Specht list, Stoddart 4224; Masig Island: Walker (1991); Three Isles: Heatwole, s.n., Stoddart 4492 (collection lost).

Vitex negundo var. *bicolor* (Willd.) Lam — Cribb and Cribb 1985, 207

Arden Island: Walker (1991) (?) [as *Vitex negundo*]; East Hope Island: Stoddart 4637; Green Island: Smith, Specht and Clapham (1973), Gardner (1973), Fosberg 61523, Stoddart 4235; Low Isles: Stephenson et al. (1931) [as *Vitex trifolia*], Stoddart 4322; Three Isles: Stoddart 4466; Turtle I Island: Buckley 3593, 3597; Turtle II Island: Buckley 3380, 3381, 3382; West Hope Island: Stoddart 4411, Walker (1991).

Vitex ovata Thunb. — Cribb and Cribb 1985, 207-208

Arden Island: Walker (1991) (?); Eagle Island: Heatwole, s.n., Stoddart 4815; Farmer Island: Walker, sight; Fife Island: Stoddart 4956, Chaloupka and Godwin (1985); Howick Island: Heatwole, s.n., Stoddart 4849; Ingram Island: Stoddart 4041; Low Wooded Island: Stoddart 4577; Masig Island: Walker (1991); Morris Island: Stoddart 4974; Saunders Island: Stoddart 5074; Sinclair Island: Stoddart 4189; Stainer Island: Chaloupka and Godwin (1985); Three Isles: MacGillivray (1852, I, pp. 105-106), Heatwole, s.n.; Turtle III Island: Stoddart 4756; Two Isles: Stoddart 4614; Wallace Island: King et al. (1989b), Walker (1991).

Vitex trifolia var. *subtrisecta* (O. Ktze.) Moldenke

Arden Island: Walker (1991) [as *Vitex trifolia*]; Green Island: Specht list [as *Vitex trifolia*]; Three Isles: Heatwole, s.n. [as *Vitex trifolia*], Stoddart 4466.

VITIDACEAE (including LEEACEAE)

Cayratia acris

Arden Island: Walker (1991).

Cayratia cardiophylla

Arden Island: Walker (1991) (?); Douglas Island: Walker (1991); West Hope Island: Walker (1991).

Cayratia clematidea Domin

Green Island: Smith, Specht and Clapham (1973).

Cayratia grandifolia (Warb.) Merr. & Perry

East Hope Island: Stoddart 4371; Fife Island: Stoddart 4961, Chaloupka and Godwin (1985); Howick Island: Stoddart 4862; Ingram Island: Buckley 5025(?), Stoddart 4061; Low Wooded Island: Stoddart 4547; Pipon Island: Heatwole, s.n.; Sinclair Island: Buckley 5003b [as Sinclair-Morris Islands]; Three Isles: Stoddart 4513; Two Isles: Stoddart 4606; Watson Island: Stoddart 4115; West Hope Island: Stoddart 4407.

Cayratia saponaria (Seem.) Domin
Vitis saponaria Seem.

Hannibal Island: Heatwole, s.n.; Piper's Island: MacGillivray (1852, I, p. 117), MacGillivray in Bailey, Fl. Qd., p. 280; West Cairncross Island: Heatwole, s.n., Walker (1991); West Hannibal Island: Walker (1991).

Cayratia trifolia (L.) Domin

Arden Island: Walker (1991); Arnold Island: Buckley 3906; Binstead Island: Buckley 5062; Chapman Island: Heatwole, s.n.; Douglas Island: Buckley 5246, Walker (1991); Dugong Island: Buckley 5286a; Farmer Island: Buckley 3825a; Hannibal Island: Heatwole, s.n.; Howick Island: Heatwole, s.n.; Low Wooded Island: Stoddart 4576; Morris Island: Buckley 3709; Nymph Island: Heatwole 124; Pipon Island: Stoddart 4876; Saunders Island: Stoddart 5068; Sinclair Island: Buckley 5003a [as Sinclair-Morris Islands]; Three Isles: Heatwole, s.n.; Turtle I Island: Stoddart 4680; Turtle III Island: Stoddart 4739; Turtle V Island: Buckley 3539; Two Isles: Stoddart 4629; West Hannibal Island: Walker (1991).

Cayratia sp.

Arden Island: Walker (1991); East Hannibal Island: Walker (1991); Farmer Island: MacGillivray (1852, I, p. 117) [as *Cissus* sp.]; Green Island: Specht list; Turtle II Island: Buckley 3401; Turtle III Island: Buckley 3561; Turtle V Island: Buckley 3543; Turtle VI Island: Buckley 3502.

Leea sambucina Willd.

Howick Island: Mueller in Bailey, Fl. Qd., p. 384 [as 'Howick's Group].

ZOSTERACEAE

Cymodocea rotundata Ehr. & Hempr. ex Aschers.

Batt Reef: Tandy 84 (BM) (in Den Hartog 1970); Pipon Island: Stoddart 4906.

Cymodocea serrulata (R. Br.) Aschers. & Magnus. Cribb and Cribb 1985, 239

Green Island: S. T. Blake 22084 (BRI) (in Den Hartog 1970).

Halodule uninervis (Forssk.) Aschers. Cribb and Cribb 1985, 240

Low Isles: Stephenson et al. (1931) [as *Diplanthera uninervis*], Den Hartog 908 (in Den Hartog 1970), S. T. Blake 22086 (BRI) (in Den Hartog 1970), Fosberg 55021, Stoddart 4311, 4312.

Syringodium isoetifolium (Aschers.) Dandy Cribb and Cribb 1985, 240

Pipon Island: Stoddart 4908.

Zostera capricorni Aschers. Cribb and Cribb 1985, 246

Nymph Island: Stoddart 4792.

ZYGOPHYLLACEAE

Tribulus cistoides L. Cribb and Cribb 1985, 209-210

Arden Island: Walker (1991); Beesley Island: Stoddart, sight; Bewick Island: Stoddart 4178; Bramble Cay: Queensland Herbarium (in Walker 1988); Bushy Island: Walker (1991); Chapman Island: Stoddart, sight; Coombe Island: Stoddart 4034; Dalrymple Island: Walker, s.n.; Douglas Island: Walker (1991); Dove Island: Walker (1991); Eagle Island: Heatwole, s.n., Stoddart 4819; East Hope Island: Stoddart 4445; Farmer Island: Walker, sight; Fife Island: Steers (1938), Heatwole, s.n., Stoddart 4956a, Chaloupka and Godwin (1985); Green Island: Specht list; Hannah Island: Heatwole, s.n.; Howick Island: Mueller in Bailet, Fl. Qd., p. 172 [as 'Howick's Group'], Heatwole, s.n.; Ingram Island: Stoddart 4075; Magra Island: Stoddart, sight; Masig Island: Walker (1991); Michaelmas Cay: Stoddart 4216; Morris Island: Stoddart 4978; Newton Island: Stoddart 4142; Nymph Island: Heatwole 127; Pelican Island: Stoddart 4922; Pipon Island: Heatwole, s.n., Stoddart 4891; Raine Island: Stoddart 5055, Hacker (1990); Saunders Island: Stoddart 5075, King

and Limpus (1989); Sherrard Island: Stoddart 5023 (collection lost); Sinclair Island: Buckley 3702; Stainer Island: Stoddart 4914, Chaloupka and Godwin (1985); Stapleton Island: Stoddart 4003; Three Isles: MacGillivray (1852, I, pp. 105-106) [as *Tribulus*], Heatwole, s.n., Stoddart 4508; Turtle III Island: Stoddart 4740; Turtle V Island: Buckley 3384; Unnamed (Forth) Island: Buckley 3894; Wallace Island: Buckley 5207; Watson Island: Stoddart 4123; West Cairncross Island: Heatwole, s.n., Walker (1991); Wharton Island: Heatwole, s.n., Walker, sight.

Tribulus sp.

Eagle Island: Buckley 3442.

Appendix 1. Species with propagules recorded from Low Isles by Crome (1975)

ARALIACEAE

Kissodendron australianum Seem.

ARECACEAE (PALMAE)

Archontophoenix alexandrae Wendle. & Drude
Calamus sp.

BURSERACEAE

Canarium australianum F. v. M.

COMBRETACEAE

Terminalia sericocarpa F. v. M.

ELAEOCARPACEAE

Elaeocarpus grandis F. v. M.
Elaeocarpus grahamii F. v. M.
Elaeocarpus largiflorens C. T. White

ICACINACEAE

Gomphandra australiana F. v. M.

LAURACEAE

Cryptocarya sp. aff. *C. cinnamomifolia* Merr.
Cryptocarya corrugata White & Francis
Cryptocarya hypospodia F. v. M.
Cryptocarya mackinnoniana F. v. M.
Cryptocarya sp.
Beilschmiedia sp. aff. *B. oligandra* J. E. Sm.
Endiandra hypotephra F. v. M.
Endiandra muelleri Meisen.
Endiandra montana White
Litsea leefeana Merr.

MELIACEAE

Disoxylum micranthum Merr. & Peng.
Dysoxylum sp.
Xylocarpus granatum (L.) Koen.

MENISPERMACEAE

Hypserpa laurina Biels

MYRISTICACEAE

Myristica muelleri Warb.

PANDANACEAE

Freycinetia excelsa F. v. M.

PIPERACEAE

Piper sp.

PODOCARPACEAE

Podocarpus neriifolius 0. Don

RHIZOPHORACEAE

Ceriops tagal (Perr.) C. B. Rob

ROSACEAE

Prunus turnerana (F. M. Bailey) Kalkm.

SAPINDACEAE

Ganophyllum falcatum Bl.

SAPOTACEAE

Pouteria obovata (R. Br.) Baehni (as *Planchonella obovoidea*)

SOLANACEAE

Solanum mauritianum Scop.
Solanum torvum L.

VITIDACEAE (including LEEACEAE)

Cayratia sp. (as *Cissus* sp.)

Appendix 2. Species with propagules recorded from Raine Island by Hacker (1990)

ANACARDIACEAE

Buchanania arborescens (Blume) Blume
Semecarpus australiensis Engl.

APOCYNACEAE

Cerbera manghas L.
Cerbera sp. (?)
Neisosperma sp. aff. *N. kilneri*

ARECACEAE

Cocos nucifera L.
Nypa fruticans van Wurmb.

BARRINGTONIACEAE

Barringtonia asiatica (L.) Kurz

CONVOLVULACEAE

Ipomoea pes-caprae (L.) R. Br.
I. macrantha Roemer & Schultes
Merremia peltata (L.) Merr

COMBRETACEAE

Terminalia catappa L.

EUPHORBIACEAE

Actephila lindleyi (Steudel) Airy Shaw (?)
Aleurites moluccana (L.) Willd.

FLACOURTIACEAE

Pangium edule Reinw.

GUTTIFERAE

Calophyllum inophyllum L.

HERNANDIACEAE

Hernandia peltata Meisner

LEGUMINOSAE

Caesalpinia crista L.
Dioclea sp.
Entada phaseoloides (L.) Merr.
E. pursaetha DC.
Entada sp.
Erythrina variegata L.
Intsia bijuga (Colebr.) Kuntze
Mucuna spp.

MELIACEAE

Xylocarpus granatum Koenig

PANDANACEAE

Pandanus spp.

STERCULIACEAE

Heritiera littoralis Dryander

RHIZOPHORACEAE

Bruguiera sp.
Rhizophora sp.

RUBIACEAE

Guettarda speciosa L.

Appendix 3. Island localities

Aplin	11°12'S.	143°02'E.
Arnold	11°31'S.	143°04'E.
Baird	12°15'S.	143°13'E.
Beesley	12°11-1/2'S.	143°12'E.
Bewick	14°26'S.	144°49'E.
Binstead	13°13'S.	149°34'E.
Buchan	11°51'S.	143°19'E.
Chapman	12°53'S.	143°36'E.
Cholmondeley	11°23'S.	143°04'E.
Combe	14°24'S.	144°54'E.
Coquet	14°32-1/2'S.	144°59'E.
Douglas	11°14'S.	142°59'E.
Dove	10°00'S.	145°02'E.
Dugong	10°30'S.	143°05'E.
Eagle	14°42'S.	145°23'E.
East Cairncross	11°15'S.	142°56'E.
East Hannibal	11°16'S.	142°57'E.
East Hope	15°44'S.	145°28'E.
East Pethebridge	14°44'S.	145°06'E.
Farmer	12°15'S.	143°13'E.
Fife	13°39'S.	143°43'E.
Fisher	12°16'S.	143°14'E.
Green	16°45-1/2'S.	145°58-1/2'E.
Halfway	11°24'S.	142°58'E.
Hampton	14°34'S.	144°53'E.
Hannibal	11°36'S.	142°57'E.
Houghton	14°31-1/2'S.	144°58'E.
Hay	13°40'S.	143°41'E.
Ingram-Beanley	14°25'S.	145°53'E.
Kay	12°14'S.	143°16'E.
Leggatt	14°33'S.	144°40'E.
Little Boydong	11°29'S.	143°02'E.
Low	16°23'S.	145°34'E.
Low Wooded	15°05'S.	145°23'E.
Lowrie	13°17'S.	145°36'E.
Macarthur	11°44'S.	142°59'E.
Magra	11°51-1/2'S.	143°17'E.
Newton	14°30'S.	144°55'E.
Nymph	14°39-1/2'S.	145°15'E.

Pipon	12°14-1/2'S.	143°13-1/2'E.
Michaelmas	16°36-1/2'S.	145°59'E.
Milman	11°10'S.	143°01'E.
Morris	13°30'S.	143°43'E.
Night	13°11'S.	149°34'E.
Pelican	13°55'S.	143°50'E.
Pirie	11°35'S.	142°54'E.
Raine	11°36'S.	144°01'E.
Saunders	11°42'S.	143°11'E.
Sherrard	12°59'S.	143°34'E.
Sinclair-Morris	14°33'S.	144°54'E.
South Bird	11°47'S.	143°06'E.
Stainer	13°57'S.	143°50'E.
Stapleton	14°19'S.	144°51'E.
Sudbury	16°57'S.	146°09'E.
Three	15°07'S.	145°17'E.
Turtle I	14°44'S.	145°11'E.
Turtle II	14°44'S.	145°12'E.
Turtle III	14°44'S.	145°11'E.
Turtle IV	14°43-1/2'S.	145°12'E.
Turtle V	14°42'S.	145°12'E.
Turtle VI	14°43'S.	145°10-1/2'E.
Two	15°01'S.	145°27'E.
Upolu	16°41'S.	145°56'E.
Wallace	11°27'S.	143°02'E.
Watson	14°28'S.	144°49'E.
West Cairncross	11°15'S.	142°56'E.
West Hannibal	11°36'S.	142°57'E.
West Hope	15°45'S.	145°27'E.
West Pethebridge	14°44'S.	145°05'E.
Wharton	14°07'S	144°00'E.

R. Buckley supplied coordinates for islands on which he collected.

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The curation of specimens as they arrived from the field during the Royal Society and Universities of Queensland Expedition to the Northern Great Barrier Reef in 1973 was carried out by the staff of the Queensland Herbarium, Brisbane. We thank the late Dr. S. Everist, then Director, and his staff, for coping with this material. The Queensland Herbarium subsequently made available to us the collections later made by R. Buckley and H. Heatwole. Final determinations on this large body of material were made by Fosberg during Stoddart's tenure of a Regents Fellowship at the Smithsonian Institution in 1985. We thank the Royal Society, the University of Queensland, and James Cook University for the support of the 1973 expedition.

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Index of Specific Names

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PHYTOGEOGRAPHY AND VEGETATION OF THE REEF ISLANDS OF THE NORTHERN GREAT BARRIER REEF

BY

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WASHINGTON D.C., U.S.A.

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PHYTOGEOGRAPHY AND VEGETATION OF THE REEF ISLANDS OF THE NORTHERN GREAT BARRIER REEF

BY

DAVID R. STODDART[1] AND F. RAYMOND FOSBERG[2]

Introduction

Until 1973 the vegetation and flora of the reef islands of the northern Great Barrier Reef were among the least known of those of all the world's reef islands. Apart from collections made by Joseph Banks, on Cook's first expedition in *Endeavour*, Robert Brown with Flinders in *Investigator*, Allan Cunningham with Philip Gidley King, and (on a larger scale) F. von Mueller, included in Bailey's *Flora of Queensland* (1899-1905), the only extensive floristic records were those of MacGillivray (1852), who recorded 19 species from a total of 12 islands during the voyage of H.M.S. *Rattlesnake* in 1846-1850. Steers (1938, 92) listed 10 species from Fife Island, determined by W. D. Francis, and Stephenson *et al* (1931) 25 species from Low Isles and 12 species from Three Isles, all presumably based on collections by G. Tandy. Den Hartog (1970) has summarised sea-grass records, mainly from Low Isles. Otherwise the only island in the northern province for which a full floristic record existed was Green Island, where a large proportion of the species is exotic (Smith, Specht and Clapham 1973, Gardner 1973). It is not perhaps surprising, therefore, that it was generally concluded that

> 'the terrestrial flora of the cays is a very restricted one, of only 30 to 40 species, practically all of which are of wide distribution in the Indo-West Pacific province and are characteristic of strand line environments and of environments of shifting lime sand' (Hill 1970, 76; 1974, 725).

Such an interpretation is certainly reinforced by (and indeed largely derives from) work on the Bunker and Capricorn Islands at the southern end of the Reef. These islands are well known both from earlier studies (Longman 1913, White and Macgillivray 1926, Macgillivray and Rodway 1931), more detailed recent work at Heron Island (Fosberg and Thorne 1961, Gillham 1963), at Wilson, Northwest, Hoskyn and Fairfax Islands (Cribbs 1965, 1969, 1972, 1986), and throughout the southern islands by Chaloupka and Domm (1985, 1986). Most of these southern islands have 20-40 species of vascular plants, with a substantial proportion of introductions, a total flora of ca 80 species, and a restricted series of vegetation types dominated by *Pandanus* and *Pisonia* forest and herbaceous communities. At Heron Island, with the largest number of species (51), half (26) are introductions (Chaloupka and Domm 1986, 1540).

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[1]Department of Geography, University of California at Berkeley, Berkeley, California

[2]Department of Botany, National Museum of Natural History, Smithsonian Institution, Washington, D.C.

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Studies during the Royal Society and Universities of Queensland Expedition to the northern Great Barrier Reef in 1973 revealed a markedly different picture. 1107 numbers of plants, generally each in five sets, were collected from 40 islands or island-groups, and sight records were obtained from a further 19 island-groups during detailed mapping of the islands between 16°57'S in the south (Sudbury Cay) and 11°36'S in the north (Raine Island). These collections, together with others made subsequently by R. Buckley, H. Heatwole, and T.A. Walker, comprise over 380 species of flowering plants in 86 families, together with some lichens and fungi. Not only is the flora different in important respects from that of any other reef province so far studied, reflecting its Australian affinities, but the vegetation units which can be recognised do not in some cases have counterparts in other reef areas. This paper discusses the biogeography and floristics of the northern islands, and describes the main vegetation units of the islands and their relationship to topography, substrate and other ecological controls. It should be read in conjunction with the systematic treatment of the flora by Fosberg and Stoddart (1991).

Biogeography

The known flora of the reef islands (i.e. excluding high islands) of the Great Barrier Reef is ca 410 species and subspecies; this figure does not include the large number of records of exotic pot plants made by Fosberg (1961) at Heron Island. Of these, over 330 are known only from the northern area (north of Cairns, 16°45'S), 33 are known only from the Bunker and Capricorn Islands in the south, and only 43 are common to both provinces. These figures derive from the listing of the plants of the northern islands by Fosberg and Stoddart (1991), and of the southern islands by Chaloupka and Domm (1986). While some revision of the numbers is to be expected and while there are possibilities of nomenclatural differences in the two lists, there is no question of the remarkable distinctiveness in the floras of the two sets of islands. This difference had not previously been recognized before these recent collections were made on the northern Great Barrier Reef. Table 1 lists plants only recorded from the northern islands, Table 2 those only recorded from the southern islands (25 of the 33 species there listed are judged by Chaloupka and Domm (1985) to be introductions), and Table 3 lists the species common to both provinces. A major element in this distribution pattern is the absence of mangroves, sea-grasses, and rock-platform succulents from the southern province: 15 species of mangroves, 7 of sea-grasses, and 4 succulents are recorded only north of Cairns, while two species of sea-grasses are common to both north and south. If these ecological groups are excluded from the analysis, the northern sector has some 330 species of vascular plants, of which perhaps one-third are introduced.

The first striking point about the floras of the southern and northern islands is that the former are Indo-Pacific or pantropical in character and the latter are distinctively Australian. In the south the two dominant vegetation units are *Pisonia* forest and *Pandanus tectorius* forest, both of wide distribution. Other common trees are the wide-ranging *Casuarina equisetifolia, Cordia subcordata, Celtis paniculata,* and *Pipturus argenteus*. The strand flora comprises wide-ranging Indo-Pacific species including the shrubs *Tournefortia argentea, Scaevola taccada,* and *Suriana maritima,* as well as common herbs.

In the north, the main tree species are strikingly different. *Casuarina* and *Cordia* are widespread, but both *Pisonia* and *Pandanus* are relatively uncommon, though there is a single specimen of both as species and in forming vegetation units, and neither *Celtis* nor *Pipturus*

have been recorded (the latter more than fifty years ago at Green Island). The common woodland trees include *Aglaia elaeagnoidea, Diospyros maritima, Eugenia carrisoides, Exocarpos latifolia, Ficus opposita, Manilkara kauki, Mimusops elengi, Pouteria obovata, Terminalia arenicola,* and *Terminalia muelleri.* Among larger shrubs *Capparis lucida* is very common. Most of these species are unknown in the vegetation of Indian and Pacific Ocean reef islands, and they impart a distinctively Australian aspect to the flora. This was recognised by Fosberg (1974), who identified a 'Coral Sea element' on some of the Great Barrier Reef cays, but the five species he then named comprising it included three mangroves and only one tree species (*Ficus opposita*) from the above list. Because this flora appears to be largely restricted to the northern Barrier Reef, and to be absent in the south, and because there are at present no records to suggest that these characteristic plants reach the more remote reef islands of the open Coral Sea, it may be more appropriate to speak of a 'North Queensland element' than a 'Coral Sea element'. As a further qualification, it should be noted that there are some conspicuous anomalies in labelling the southern flora Indo-Pacific in character and the northern one Australian. For example the common Indo-Pacific atoll trees *Guettarda speciosa* and *Thespesia populnea* are among the most widespread in the north, but are unaccountably absent in the south.

The Australian component on the northern islands extends also to the inland (but not the coastal) shrubs. In addition to *Capparis lucida* these include *Elaeodendron australe, Elaeodendron melanocarpus, Micromelum minutum,* the very common and distinctive *Myoporum acuminatum,* and *Vitex trifolia.* The inland shrub flora does also include, however, several very wide-ranging species which may have successfully established themselves after being introduced. They include *Clerodendrum inerme, Colubrina asiatica, Caesalpinia bonduc,* and *Premna corymbosa.* Distinctively Australian vines in these inland communities include species of *Cayratia* and *Hoya.*

The second striking point to note is that if the island woodland flora is of clear Australan affinity, the littoral flora has a more Indo-Pacific or cosmotropical composition: this alone suggests that the two components have very different dispersal mechanisms and histories. Widespread and common coastal shrubs include *Pemphis acidula* (strangely absent in the south), *Scaevola taccada, Suriana maritima,* and *Tournefortia argentea;* common herbs *Achyranthes aspera, Canavalia maritima, Cassytha filiformis, Cleome viscosa, Euphorbia atoto, Ipomoea macrantha, Ipomoea pes-caprae, Sesuvium portulacastrum, Tribulus cistoides, Tridax procumbens, Vigna marina,* and *Wollastonia biflora;* and common grasses *Lepturus repens, Spinifex hirsutus, Sporobolus virginicus,* and *Thuarea involuta.* The littoral trees *Casuarina equisetifolia, Cordia subcordata, Guettarda speciosa,* and *Thespesia populnea* also fall into this category. A few Australian endemics, notably *Euphorbia eremophila* and *Josephinia imperatricis,* are found in both inland and nearshore situations.

Nevertheless, in spite of this heavy Indo-Pacific strand representation, a number of expected species are rare or missing in the northern reef islands. *Hernandia sonora* was seen only as a seedling on West Hope Island; *Calophyllum inophyllum* (other than probably planted trees on Green Island and Low Isles) is also found on the reef islands only as a seedling, though common on Lizard Island (Byrnes et al. 1977); *Morinda citrifolia* is more widespread but frequently only as a seedling, as on West Hope, Low Wooded Island, and Two Isles; *Cordia subcordata* is present on Low Wooded Island only as a seedling. Drift seeds of *Barringtonia asiatica* are widespread but do not survive, and the species is unrepresented in the flora, in spite of its abundance north of Torres Straits. Many other species are represented by drift seeds along the beach crests (*Entada* and *Mucuna* are very abundant) but never germinate. The drift seeds of Low Isles and Raine Island have recently been reported by Crome (1975) and Hacker (1990).

The coconut *Cocos nucifera* presents a similar case. There are obviously planted trees on Green Island, Low Isles and Three Isles, though those on the latter (survivors of plants reported by the 1928-1929 Expedition) were felled by casual visitors in 1973. There are probably planted trees on Nymph, Turtle II, Turtle IV and Turtle V Islands. There is a single tree on Morris Island. Otherwise in the whole province we observed but sixteen recently planted juveniles on Magra, one on Saunders, one on Kay, and two germinating nuts on Sudbury Cay, an otherwise unvegetated island where the species will not survive. Walker (1990) has recorded the species on five further islands. Steers (1938, 92) also found planted coconuts at Night Island, which was not visited in 1973. The absence of natural coconuts on this coast is remarkable. Cook found two nuts covered with barnacles at the Endeavour River in 1770 (Banks 1962, II, 86, 88), Flinders (1814, II, 49) found one in Shoalwater Bay, and King (1820, I, 194) a single mature tree at Cape Cleveland in 1819. The contrast with the high islands of the Torres Straits, where Flinders (1814, II, 111) found 'abundant' coconuts at Murray Island is of obvious cultural rather than natural origin. However, during 1898-1899, Cdr Parry, H.M.S. *Dart*, surveying the inner reefs, planted a number of islands with coconuts 'for the use of navigators or for the benefit of shipwrecked mariners' (Day 1967, 290), but this seems to have had little lasting effect. It is worth noting that few of the high islands of the northern reef province possess coconuts either, though there is a small plantation on the Forbes Islands near Cape Grenville.

Two immediate questions arise from this discussion of plant biogeography on the Great Barrier Reef. First: why are the Barrier Reef islands so different from those of Indo-Pacific reefs in general? Second: why is the Australian element so obvious in the northern islands and absent in the south? Two possibilities may be suggested. First, the flora of the northern islands may be to some degree inherited from that of last low sea-level times (before 6000 years B.P.) when the entire coastal shelf was dry and presumably vegetated; such persistence from earlier and different environmental conditions has been proposed to account for the existence of distinctive elements in the flora of Laysan Atoll (Schlanger and Gillett 1976). By contrast the isolated Bunker and Capricorn reefs in the south rise from a much deeper shelf, open to the Pacific. Second, the floras may have been much modified by man. Thus in the Torres Straits region the fruits of *Manilkara kauki* were a valued food (Harris 1977, 433) and this and similar species may have been introduced, encouraged, or selectively preserved on inhabited or visited reef islands. There is certainly evidence (in the vegetation of some islands, in soil constituents, and in archaeological remains) for considerable human impact on some islands, and this will be discussed in a later section.

Two further biogeographical points may be made. The first is that ferns are almost entirely absent from the northern islands, and appear to be wholly so in the south. This is particularly remarkable given the dispersal abilities of this group. There are introduced decorative ferns at Low Isles and Green Island, but the only native ferns appear to be species of *Drynaria* on Turtle I. It is remarkable that the leather fern *Acrostichum*, which is widespread on the coast of Queensland, does not reach the reef islands, even in those with extensive mangrove communities. Second, we have found only a single species of orchid (possibly two) on the northern islands; there are none in the south. The contrast in both cases with the neighbouring islands of Melanesia is striking, and emphasises the distinctiveness of the Barrier Reef area.

Numerical relationships

The data at present available are inadequate for a rigorous numerical analysis of species distribution on the different islands, partly because of the small number of islands with

comprehensive collections, partly because of the diversity of island types which makes the direct comparison of islands on the basis of area alone a meaningless exercise (a point which has been subsequently made by Buckley).

Restricting the analysis to sand cays (i.e. excluding the more complex low wooded islands with their extensive mangroves), we have data for 18 islands ranging in size from less than 0.03 ha to 16.3 ha, approximately the same range as in Niering's (1956) analysis of the Kapingamarangi islands. There is only the weakest trend of increasing number of species with increasing area: indeed, the two largest islands are Green Island, a forested island with ca 60 native plant species in a total of 114 species, and Raine Island, a seabird island with only 13 species; this latter total is exceeded by several islands only one-tenth the size of Raine. The sand cays of low wooded islands, while differing in degree of separation from their associated shingle ridges and mangroves, range in size form 0.4 to 16 ha. These again show no obvious trend in floristic diversity with increasing size, though several are known to be seriously undercollected. They are also not strictly comparable with isolated sand cays, since the shingle and mangrove components represent an adjacent reservoir of potential colonisers, usually immediately to windward of the cay.

Finally, the ten islands of the Bunker and Capricorn Groups in the southern province provide additional data. These range ins size from 1.9 to 116.7 ha. Two of those with high species numbers have a large number of introductions. Eight of the islands, with areas varying by a factor of 52, all have between 22 and 40 species (Chaloupka and Domm 1986). There is again no simple relationship between island area and floristic diversity.

The northern and the southern Barrier Reef islands do, however, appear to show distinct differences in their physical characteristic. The southern islands are in general much larger than the northern ones (respectively: mean length 1020 and 460 m, mean width 365 and 170 m, mean area 28.0 ha and 5.8 ha, range in area 2-105 ha and 0.4-27.3 ha; numbers in sample 10 and 17). Yet the usual number of native species on the southern islands is 19-30 and on the northern, better-collected islands the total species number is at least 30 and in some cases greater than 45. The species-area relationship is thus very broadly inverse. As already indicated, this appears to result from a biogeographical control, in that many northern species are absent from the southern species pool, and a further ecologically important factor is that the rainfall in the southern islands is only one-half that in the north (mean annual rainfall at Heron Island 965 mm, and at Green Island and Low Isles 2152 and 2027 mm respectively).

Variation in species numbers in the northern islands, which is real though clearly exaggerated by the incompleteness of collections, must largely reflect ecological factors rather than simply size. These include edaphic factors, including surface phosphatisation and the relative proportion of sand and shingle; the presence or absence of ground-nesting sea-birds; and human interference. Certainly a great deal more work is required before useful conclusions can be drawn about diversity-area relationships. With present knowledge these appear to overlap the distributions previously established for reef islands in Belize, Kapingamarangi, and the Leeward Hawaiian Islands.

Vegetation types

The main characteristics of reef islands in the northern province have been described by Stoddart *et al* (1978) and by McLean and Stoddart (1978). Islands are of the following types:

(a) Unvegetated sand cays, usually oval-shaped, up to 400 m long and 120 m wide, with a mean area of 0.5 ha.

(b) Vegetated sand cays, up to 580 m long and 250 m wide, with a mean area of 5.8 ha. The upper surfaces of these cays range in height from 5 to 7.3 m, but many of the larger ones have a lower terrace at 3.5-4.5 ha.

(c) Low wooded islands, reefs with windward shingle ramparts and platforms of cemented shingle-rock, a leeward sand cay, and a reef-top mangrove swamp of variable extent. The leeward cays of low wooded islands resemble ordinary vegetated sand cays, but are often larger (mean area 12 ha), and may be partly surrounded by mangroves.

(d) Complex sand and shingle island, in which no simple distinction can be made between a sand cay and shingle ramparts.

The main types of sediment encountered by (McLean and Stoddart 1978, Scoffin and McLean 1978) are:

(a) Carbonate sands.

(b) Coral shingle and rubble ridges.

(c) Lithified coral rubble and shingle forming moderate to well cemented rock platforms at levels varying from intertidal to 2.8 m.

(d) Intertidal sediments varying from silty sands to coral rubble.

The only significant non-limestone material on the cays is pumice, either in the form of large boulders or small pebbles, which very locally may form a complete surface cover. Some islands have superficial phosphorites formed following guano deposition by seabirds.

This section provides a simple empirical classification and description of the main vegetation units of the islands, in terms both of species composition and of location with respect to the main topographic features of the islands.

1. Initial plant colonisation on sand cays

Unvegetated cays in the northern province vary from sandbores overtopped by swash at high tide, up to 0.4 ha in area (e.g. Binstead Cay, Chapman Cay, Pickersgill Cay), to larger islands such as Arlington, Sudbury and Mackay (0.5-1.4 ha) and relict islands of 0.4-2.8 ha which have undergone major cyclone damage and which may have been vegetated in the past (e.g. Ashmore, Ellis, Waterwitch). Some of these larger islands are intermittently colonised by vascular plants. Sudbury in 1929 had 'seven small seedlings, one of *Ipomoea* (?) and six of *Sesuvium portulacastrum*' (Steers 1929, 257); in 1936 there were no plants at all (Steers 1938, 67-68); and in 1973 there were three coconut seedlings and a small patch of Sesuvium. Mackay in 1929 'was well covered in its higher parts by grasses and creeping plants' (Steers, 1929, 257) by 1936, following a cyclone in 1934, the continuous vegetation cover had disappeared and had been replaced by two or three clumps of grass, a single *Ipomoea*, and a few other plants (Steers 1938, 70); in 1973 there were four coconut seedlings but no other plants. In 1936 Arlington had a vegetated area of 0.05 ha, with grasses and creepers, but was being eroded (Steers 1938, 68); in

1973 it had no plants or even drift seeds. Pickersgill, once slightly vegetated, had no plants in 1929 (Spender 1930, 265) or 1973.

The size of islands lacking any terrestrial vegetation (up to 2.8 ha in the case of Waterwitch) is surprising. On the Belize barrier reef all cays larger than 0.1 ha are vegetated, and at Kapingamarangi Atoll 50 are all islets larger than 0.01 ha. The difference presumably reflects the greater instability of Great Barrier Reef islets in an area of high tidal range and cyclonic activity.

2. Beach-crest scrub and herbaceous vegetation with trees

Beach crest vegetation on the vegetated sand cays in variable in composition and structure, partly as a function of island size. On small islands (Stapleton, Coombe, Eagle), where the cay surface lacks a woodland cover, the beach crest vegetation consists of a continous cover of herbs and grasses, extending inland, interrupted by scattered shrubs. On larger islands (Bird, Green, Farmer, East Hope) there is a more continuous zone of shrubs and low trees, with only scattered patches of herbs and grasses.

The tallest beach crest tree is *Casuarina equisetifolia*, which reaches 7-10 m on Bewick, Eagle, Ingram, Low, Low Wooded, Newton, Three, Turtle I and Two Isles. This species always occurs as scattered trees, and never forms a continuous woodland. In places, as at Green, some have been toppled by beach retreat; elsewhere height gradients suggest progressive colonisation following beach aggradation, as on the western spit of Ingram. Other occasional trees in this habitat are *Guettarda speciosa* (up to 5 m tall), *Thespesia populnea* (which reaches a height of 8 m on East Hope), and *Cordia subcordata*. Only *Cordia* forms a distinct zone of woodland, and then only on the north side of East Hope.

The most common shrubs are *Scaevola taccada*, which only occasionally exceeds 2 m in height and rarely forms a continuous zone, in contrast to many Indo-Pacific locations, and *Suriana maritima*, which is widespread but only forms a distinct vegetation unit on the south and east sides of Bird Island; except for one locality this latter species is absent from the mainland coast of Queensland. Shrubs found more rarely include *Tournefortia argentea*, *Sophora tomentosa* (up to 4 m tall on Green Island), and *Pemphis acidula*.

Common herbs include *Ipomoea pes-caprae*, especially on smaller islands such as Coombe, *Canavalia rosea*, *Euphorbia eremophila*, *Salsola kali* and *Josephinia imperatricis*. Common grasses are *Lepturus repens*, *Sporobolus virginicus*, *Thuarea involuta*, and *Spinifex hirsutus*. *Thuarea* forms a dense sward on low dunes on the east side of Ingram, but interspersed with shrubs. On Raine, however, there is an extensive zone 20-50 m wide round the entire perimeter of the island of *Lepturus* grassland on a sand substrate, and while this species is one for the most common plants of the northern islands its occurrence as a monospecific vegetation unit is here unique, though common in drier parts of the Pacific, e.g. in the Phoenix Islands.

3. Scrub and succulent sward of rock platforms

Most low wooded islands are fringed on their windward sides by lithified rubble and shingle platforms which differ in height and degree of dissection. The lower platform stands at 1.6-2.4 m, and the upper at 2.6-3.8 m above LLWS datum. Three types of vegetation are associated with these platforms:

(a) Low extensive monospecific scrub, usually 1-1.5 m tall, of *Aegialitis annulata* or *Avicennia marina*, at an elevation of 1.0-2.0 m; this scrub is almost completely submerged at HWS, and has a very even crestline and sharp boundaries.

(b) Succulent mats on the rock surface, consisting of *Suaeda australis, Salicornia quinqueflora, Arthrocnemum* (2 species), and *Sesuvium portulacastrum.* These mats are best developed on the horizontal surface of the upper platform, especially in areas frequently wetted by spray. Succulent mats are found on virtually all islands with platforms.

(c) Outposts on the inner upper platforms of the vegetation of shingle ridges, notably *Pemphis acidula* and *Sporobolus virginicus. Pemphis* is so extensive that it is treated separately (type 5).

4. Scrub and herbaceous cover of windward shingle ramparts

Ramparts of shingle, often in multiple ridges, are frequently lodged on the inner edges of conglomerate platforms. Much of the shingle is old and weathered, and its surface consists of bare, blackened and eroded coral fragments. In addition to *Pemphis,* the vegetation is dominated by *Suriana maritima, Myoporum acuminatum,* and *Capparis spinosa,* with scattered patches of *Boerhavia repens, Tribulus cistoides, Lepturus repens, Sesuvium portulacastrum, Achyranthes aspera,* and *Ipomoea pes-caprae.* The substantial stems of the vine *Cayrathia* stretch across the surface. In places there are low patches of *Abutilon.*

On inner older ridges the vegetation becomes more continuous and dense. On Green Ant Island, Low Isles, for example, *Caesalpinia* reaches 8 m in height, *Micromelum minutum* 3 m, *Vitex,* 2.5 m, *Glycosmis* 3 m, and *Clerodendrum* 2-3 m. Such vegetation either ends abruptly as the single surface passes under mangrove swamp, or its merges into inland scrub and scrub woodland (types 8 and 9).

5. *Pemphis* scrub and scrub-woodland

Pemphis acidula is one of the most common species on the northern islands, especially in exposed situations on rocky and thin shingle substrates; its absence from the southern Barrier Reef islands has already been noted. It occurs in three distinct situations:

(a) On the seaward shores of sand cays, for example on Bewick, Bird, Chapman and Sherrard. It is relatively uncommon on such sandy substrates, even where underlain by beachrock, but may form a zone up to 5 m wide, as on the north and northeast sides of Bird and the south shore of Three, and may reach heights of 4-6 m.

(b) On the inner margin of upper conglomerate platforms on the windward sides of low wooded islands, either on rock or on thin shingle ridges. It is extremely common in this habitat, where it is usually 3-5 m tall (exceptionally 6 m at East Pethebridge and 8 m at Fisher). At Low Wooded a *Pemphis* zone extends with few interruptions for about 1500 m along the south side of the island, and at Turtle V the zone is up to 50 m wide. In profile the shrubs are often wind-sheared, and in plan may show distinct windrows, giving the outer edge a crenulate margin. Such windrows have fairly constant bearing: 302° at Coquet, 300-320° at East Pethebridge, 298° at West Pethebridge, 305° at Sinclair-Morris, 320° at Turtle II. Generally *Pemphis* forms a shrub, but on some islands it occurs as a substantial tree with clear trunks up to

1 m in diameter; these were seen at Houghton, East Pethebridge, West Pethebridge and Turtle I. It might be noted that the references to *Suriana maritima* in similar habitats by Steers (1937, 1938), in accounts of King, Hay and Turtle I, probably all refer to *Pemphis*.

(c) At the junction between sand cay and mangrove swamps, on low wooded islands where the two units are in contact. Here *Pemphis* forms laterally extensive but narrow and often rather open zone, occasionally intermixed with *Osbornia octodonta*, as on Bewick, Coquet, Howick, Houghton and Turtle IV.

6. Mixed scrub and herbaceous vegetation of sand cays

An open mosaic of low shrubs, herbs, vines and grasses is widely distributed on sandy substrates in the interiors of smaller (and lower) sand cays, including the discrete sand cays of some low wooded islands. Typical of such islands are Beesley, Coombe, Eagle, Fife, Ingram, Magra, Morris, Pelican, Saunders, Sinclair, Stainer and Stapleton; all are presumably younger cays than the more densely vegetated and higher islands of other low wooded islands and the mixed sand an shingle cays.

Usually there are no single dominants. Some ten shrub species are represented, of which the most common are *Clerodendrum inerme* (1-3 m tall), *Capparis lucida* (reaching a height of 4 m at Coombe), *Colubrina asiatica* (1-3 m tall), *Premna serratifolia* (2-5 m tall), and *Scaevola taccada, Tournefortia argentea* is moderately widespread as a shrub, but on Coombe and Saunders it occurs as a tree up to 6 m tall.

The ground cover between these taller shrubs is very varied and often of low density. It includes the herbs *Boerhavia repens, Tribulus cistoides, Euphorbia eremophila, Euphorbia chamissonis, Wollastonia biflora, Sesuvium portulacastrum, Cleome viscosa, Canavalia rosea, Triumfetta procumbens, Achyranthes aspera, Portulaca australis, Stachytarpheta jamaicensis*; the vines *Ipomoea macrantha*, *Ipomoea pes-caprae, Cassytha filifomis, Cayratia* species, *Vigna marina, Abrus precatorius*, and *Hoya*; and the grasses *Sporobolus virginicus* and *Lepturus repens*.

Each of the smaller cays may have ten species or fewer in total; islands such as Sinclair, Pelican, Stainer and Lowrie are good examples of islands with 1-3 species of shrub and 3-7 species of other plants.

7. Herbaceous communities on seabird islands

These represent a modification of type 6 on Coombe, Michaelmas, Raine, Stapleton, and parts of Stainer, Morris and Magra. Shrubs are uncommon, and if present may be leafless and dead; usually only a few specimens of *Cordia, Colubrina* and *Capparis* are present. The tallest plants may be spindly *Abutilon asiaticum*, with a ground cover of *Achyranthes aspera, Lepturus repens*, and *Boerhavia repens*. Similar patches of *Abutilon* and *Boerhavia* on shingle ridges of otherwise more densely vegetated islands usually suggest a local concentration of ground-nesting seabirds. On the main bird islands the vegetation cover is very patchy, with large bare areas.

8. Scrub woodland of sandy cays

This type is similar to type 6, but with a number of taller trees. These include some littoral species, such as *Casuarina equisetifolia* (reaching 15 m in height at Green), *Cordia subcordata*, and *Thespesia populnea* (3 m tall at Bewick), but also *Terminalia muelleri* (up to 10 m tall) and *Terminalia arenicola* (up to 4 m tall). Common shrubs are *Capparis lucida, Colubrina asiatica, Clerodendrum inerme, Micromelum minutum, Myoporum acuminatum, Caesalpinia bonduc*, and *Pemphis acidula*. The ground cover is rather less diverse, with *Lepturus repens, Achyranthes aspera* and *Euphorbia atoto*.

9. Woodland of sand and sand-shingle islands

A number of larger islands are covered with dense, largely close-canopied woodland, which is undoubtedly less well-known than it ought to be. Of the 40 tree species recorded from the islands, up to 10-12 species are recorded in woodland from East Hope, Howick, Ingram, Low, Three, The Turtles, and Two Isles.

Common trees are *Diospyros maritima*, usually 5-6 tall but reaching 15 m at East Hope, *Aglaia eleagnoidea* (4-5 m tall), *Pouteria obovata* (5-10 m), *Terminalia arenicola* (3-12 m) *Terminalia muelleri* (3-10 m), *Mimusops elengi* (4-8 m), and *Manilkara kauki*. There is dense *Manilkara* woodland at Two Isles, where MacGillivray (1852, I, 107) described trees of this species 20 m tall and 1 m in diameter. Most trees now seem to be only 8 m tall; the tallest noted on the northern islands were on Low Wooded (10 m) and Turtle I (15 m). Other trees 3-8 m tall found in similar closed woodland include *Guettarda speciosa, Ficus opposita, Ficus obliqua, Ficus drupacea, Malaisia scandens, Exocarpos latifolia, Eugenia carissoides, Diospyros ferrea, Macaranga tanarius, Cordia subcordata*, and *Ganophyllum falcatum*. One of the of tallest trees on the islands is *Erythrina insularis*, reaching 10-15 m in height and often an emergent, but it is apparently confined to Bird and Farmer Islands, on both of which it was first recorded by MacGillivray (1852). In addition Cunningham recorded 'a strong luxuriant tree, having a stem six feet in diameter, whose base is much like the spurred bulb of a tropical fig' at Cairncross (King 1827, I,383-384), to which he gave the name *Gueltarda octandra*. This may be *Guettarda*; we did not visit Cairncross in 1973, nor see any tree as large as this on the northern islands.

The paucity of *Pisonia* woodland has already been mentioned, and has recently been examined by Walker (1991a). There is forest on Bird Island, and occasional trees on West Hope (respectively at 11°46'S and 15°45'S). Interior phosphate rock is associated with the *Pisonia* forest on Bird, and the occurrence of similar rock on Green Island suggests the former existence of *Pisonia* there too. There is *Pisonia* woodland with phosphate rock on the tiny island of Bushy Cay on Redbill Reef, at 21°S, but the most extensive *Pisonia* is in the Bunker and Capricorn Islands, south of 23°S. There it forms a tall forest on Heron and Northwest Islands, isolated groves on Hoskyn, and occurs occasionally on Wilson (Cribb 1965, 1969, 1972; Fosberg 1961); it is also recorded from Masthead, Tyron, One Tree, Fairfax, Lady Musgrave and Wreck Islands (Macgillivray and Rodway 1931). Why *Pisonia* is so rare in the north is unknown. Similarly *Pandanus tectorius* is rare in the north and nowhere forms a vegetation unit. In the south there are extensive *Pandanus* groves with deep litter on Wilson, One Tree and Hoskyn Islands (Cribb 1965, 1972).

In addition to the tree species, the islands with tall woodland have a number of characteristic shrubs, mostly 3-5 m tall. They include *Premna serratifolia, Myoporum acuminatum, Elaeodendron australe, Glycosmis pentaphylla, Phyllanthus reticulatus*, and

Micromelum minutum. These are well seen at such islands as Howick, Turtle I, Low Wooded and Ingram.

Because of the canopy density, herbs and grasses are few; where they occur they are the same as those represented in type 8.

10. Mangroves

The mangrove vegetation of the northern islands has been discussed in a separate paper (Stoddart 1979) and will only be briefly outlined here. Mapping of 21 low wooded islands with mangroves yielded a mean mangrove area of 19.7 ha, but with extremes ranging from 0.3 to 125.4 ha; 12 of the reefs have less than 12 ha of mangroves. As a percentage of the reef top the mean mangrove cover is 18.2%, the range 1.1-67.7%, and the modal class (classes of 10%) is 0-10%. Elevations in the following account refer to the datum of LLWS; the height of MHWN is 1.6 m and MHWS 2.3 m. The following main types of mangrove vegetation may be recognised:

(a) *Aegialitis annulata* scrub, 1-2 m tall, on higher reef flat and lower conglomerate platform surfaces on the windward sides of low wooded islands. It is very common from Chapman in the north to Low Isles in the south; it has not been recorded on the reef south of Low Isles. Though usually a low shrub, this species forms trees up to 5 m tall in clearings in mature mangrove woodland, e.g. at Nymph and Turtle I. The windward scrub forms mainly in the height interval 1.3-1.6 m LLWS.

(b) *Avicennia marina* scrub, 1.5 m (exceptionally 3 m) tall, occurring in similar situations to *Aegialitis* scrub on low wooded islands. On platforms it occurs up to 1.6 m above datum.

(c) *Avicennia* woodland in the lee of platforms and shingle ramparts. This reaches heights of 8 m at Chapman and Sherrard and 10 m at Fisher, but it never forms a very extensive unit.

(d) *Ceriops* thicket, consisting of dense slender trees of *Ceriops tagal* at higher levels (up to 2.5 m), often immediately in the lee of platforms or close to the mangrove shore of low-wooded-island sand cays. Exceptionally this species is found in ponded situations between 3.5 and 4.4 m above datum; at Low Wooded Island it reaches 3.0 m. The trees frequently reach a height of 5 m (e.g. at Lowrie, West Pethebridge, and Turtle I), but at East Pethebridge they reach 8 m and at Low Wooded 10 m. In other places they may only reach 2-4.5 m.

(e) *Rhizophora mucronata* var. *stylosa* woodland. This is the dominant mangrove community of the reef tops, and exceptionally forms a closed canopy forest 20 m tall, with stilt roots reaching 3 m above the surface. Tall *Rhizophora* woodland (8-15 m) is found at Chapman, Fisher, Low, Low Wooded, East Pethebridge, West Pethebridge and Sherrard. The edge of the mangrove, where it extends only part of the way across the reef top, is either a wall of tall trees, as at Three Isles, or an extensive field of seedlings up to 2 m tall, as at West Hope. There may be occasional trees of *Sonneratia alba* along the margin, e.g. at Chapman; this species has not been recorded on the Reef south of Three Isles.

(f) *Osbornia* thicket. A woodland of closely-set trees of *Osbornia octodonta* is characteristic of high-standing substrates at the junction of mangrove swamp and shingle ridge on the windward sides of low wooded islands. Because of its exposed situation, the trees are often wind-sheared, and frequently movement of the shingle ridges during storms has left tall trees of *Osbornia* standing on the reef flat outside the ridges. In dense *Osbornia* woodland many

of the trunks and branches are almost horizontal towards the edge of the unit, presumably in response to light. The woodland reaches heights of 8-9 m at Low, Low Wooded and West Pethebridge, but also forms a low scrub 2-4 m tall at Chapman, Bewick, and Sinclair-Morris.

(g) Mangroves at higher levels. Perhaps the most extensive of these is *Bruguiera* woodland, though not enough is known of its local extent to define and map a vegetation unit. It is well developed at Bewick, Watson, Newton and Howick, and is usually 5-8 m tall. More work is needed to define the occurrences of the three different species (*B. cyclindrica, B. exaristata, B. gymnorrhiza*) which are present. *Excoecaria agallocha* is common round cay and shingle ridge margins, usually as scattered trees 3-6 m tall. *Xylocarpus australasicus* and *X. granatum* also occur in similar situations, and even on dry land, again as tall individual trees; this genus has not so far been recorded south of the Howick Group.

11. Sea-grass meadows

Extensive meadows of sea-grasses on reef tops not occupied by mangroves are dominated by *Thalassia hemprichii*. They have been described at Low Isles by Den Hartog (1970), who notes that this species, though widespread on the reefs, is apparently absent from the mainland coast. Species of other genera (*Halophila, Halodule, Zostera, Enhalus*) are also present but less conspicuous; *Halodule* often forms a narrow zone of turf at the foot of beaches on fine sand in sheltered water.

12. Man-modified vegetation

It is at present impossible to estimate the degree of human modification of the vegetation of the northern islands, though there is little doubt that many were regularly visited or occupied by aborigines over a long period, some have since been occupied by Europeans, and the often abrupt contrasts between the vegetation units of adjacent and similar islands suggests some degree of disturbance. Several types of modification may be suggested:

(a) Anthropogenic grasslands. Several cays are covered with a probably man-induced grassland in place of the expected scrub or scrub woodland. This is most apparent at Three Isles, where they cay is largely covered with *Panicum maximum* 1.5 m tall. Much of Bewick Cay is covered with grasses, including *Heteropogon triticeus* up to 1.7 m tall. *Imperata cylindrica* on Morris reaches 1 m and so does *Heteropogon contortus* on Howick.

(b) *Agave* thicket. *Agave rigida* var. *sisalana* covers about half the vegetated area (i.e. about 2.3 ha) on Morris Island. It was not seen by MacGillivray (1852) in 1846, but W. Macgilivray (1910, 220) found 'a clump of sisal hemp' in October 1910. It is probably now impossible to eradicate, and will doubtless extend to cover the island. Fortunately it has not been introduced elsewhere.

(c) Modification by Europeans on cays now inhabited (Low, Green) or inhabited in the past (Pipon): the removal of natural woodland and scrub, the introduction of exotic trees and decorative plants, and the arrival of weeds.

(d) Possible modification of woodland by aborigines, especially through the selective encouragement of useful trees.

Ecological factors

It would be premature to attempt any full explanation of the vegetation patterns here reported, but it might be useful to draw attention to certain factors which may have influenced their development.

Age

As a result of the 1973 Expedition a great deal is known of the age of topographic features on the reef tops in the northern province. The sediments of older, higher parts of sand cays cluster in the range 2900-3400 years B.P., and it appears that the main outlines of the larger islands were formed before 3000 years B.P. It is these areas which support the closed-canopy woodland. The lower terrace which in places surrounds these higher central core-islands is composed of sediments averaging about 2700 years in age, but the feature itself may have formed much more recently than this. The age difference between the two levels on the bigger cays, and between the larger islands and the smaller ones, certainly supplies a major reason for the difference in vegetation between them (for details, see McLean and Stoddart 1978). As previously mentioned, it is, moreover, possible that some part of the flora of the larger forested islands is relict from last glacial times (ca 8000 years B.P.) when the northern coastal shelf was dry land and when the present reefs were limestone hills upon it.

It has also been found that the more extensive mangrove forests of the low wooded islands overlie fossil reefs, the oldest of which date from the time when sea-level reached approximately its present level after the last main transgression. The oldest microatolls in such reef-top reefs date from 6310 years B.P.; others extend to 2370 years B.P., and some are still forming as reef tops grow up to present sea-level. It is also likely that mangroves owe their initial location on reef tops to the sheltering effect of windward shingle ramparts, and the ages of the upper conglomerate platform (a cemented rampart) on the low wooded islands range from 4420 to 3050 years and cluster between 3300 and 3600 years B.P. It has been suggested that mangroves are more extensive where such reef-top reefs formed earliest, and that the formation of a field of microatolls on the reef top triggers the rapid expansion of mangrove vegetation (Stoddart 1979). Hence differences in initial reef geometry could control the great differences found in the extent of mangroves between adjacent reefs, because of the different amounts of limestone deposition needed to bring the reef to present sea-level.

Rainfall

It has already been mentioned that the mean annual rainfall at Green Island (2152 mm) and Low Isles (2027 mm) is substantially greater than that at Heron Island in the south (965 mm). There are no other island records available between Low Isles and Thursday Island (1739 mm). Nevertheless, some of the islands north of Princess Charlotte Bay had a distinctly arid aspect (admittedly during the 1973 dry season), and the rainfall at Raine Island could well be as low as 1000 mm. Rainfall variation within the northern province could thus be an important ecological control.

Cyclones

Cyclones have occurred roughly 6-12 times per decade during the present century in the northern province. They have major topographical effects, especially in altering the location and size of shingle ramparts, and thus incidentally through movement of the substrate leading to destruction of vegetation. They also have direct effects on the vegetation itself, mainly through wind action. This is most marked in mangrove woodland. Steers (1938) noted extensive devastation of mangroves on Houghton, Wilkie and Night Islands, and the same was seen in 1973 on Newton and Houghton. The effects of this periodic destruction on pattern and succession in the mangrove woodlands has yet to be investigated. Wind damage during cyclones is undoubtedly also responsible for the feeling of some taller trees, such as *Casuarina* at Three Isles.

Seabirds

A number of the reef islands are important seabird nesting sights (Serventy *et al* 1971, Lavery and Grimes 1971, Kikkawa 1976). The birds have both mechanical and chemical effects on soil and vegetation, and we have noted the characteristic vegetation of seabird islands (type 7). Three groups of seabirds are important modifiers of vegetation:

(a) Boobies. The Brown Booby *Sula leucogaster* nests at Waterwitch, Ashmore, Pandora (all unvegetated), and Raine (in unvegetated areas). The Masked Booby *Sula dactylatra* nests on Pandora (unvegetated) and on unvegetated parts of Raine. These heavy birds would undoubtedly locally suppress vegetation in any nesting area; and they may have been more widespread in the past.

(b) Terns and Noddies. The Sooty Tern *Sterna fuscata* nests in extremely large numbers on Michaelmas and Stapleton, as well as on Raine, Pandora, Low, Upolu and Saunders. The Noddy *Anous stolidus* nests mainly on Michaelmas but also on Raine, Howick and Upolu. The nesting areas have a vegetation of grasses (*Lepturus repens*) and herbs (notably *Boerhavia repens*), and other plants, especially shrubs, are probably suppressed. Walker (1991a) has discussed the role of the Black Noddy *Anous minutus*, the Bridled Tern *Sterna anaethetus*, and the Wedge-tailed Shearwater *Puffinus pacificus*, in the dispersal of *Pisonia grandis*.

(c) The Pelican *Pelecanus conspicillatus*. This breeds and is still numerous on Coombe, Pelican and Sinclair. Its effects are much more local than those of the other seabirds, but nevertheless identifiable.

Not a great deal of work has been done on the effects on vegetation of tropical seabirds on reef islands, but reference may be made to Gillham's observations (1977a, 1977b) on Aldabra and Cosmoledo Atolls.

Landbirds

The Torres Strait Pigeon *Ducula spilorrhoa* is likely to be of particular significance in the dispersal of plants with fleshy fruits, and it could be particularly important in explaining the distribution of some of the distinctively Australian trees of the larger cays. It is seasonally abundant at Cairncross, Howick, Hope, East Pethebridge, and Low (where it has recently been studied by Crome 1975), and probably at many other islands. It would be interesting to compare

its food preferences with the plant species present on the cays: Crome (1975) has provided a list of propagules at Low Isles not present as viable plants in the present flora.

Turtles

Sea turtles, notably the Green Turtle *Chelonia mydas,* are probably relatively uncommon on most northern islands at the present day. The major exception is Raine Island, which is probably the largest Green Turtle rookery in the world, with a population of 11,000 in 1974. The turtles nest in *Lepturus* grassland, which undergoes constant mechanical disturbance in consequence. It is likely that turtle rookeries were much more extensive in the past.

Man

The presumed effects of both aboriginal and European man on island vegetation has been mentioned several times. Beaton (1978) has summarised archaeological evidence of the occupation of the northern islands, especially for the reef islands Howick, Pipon, Ingram, Bewick, Nymph and the Turtles.

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NO. 350

PISONIA ISLANDS OF THE GREAT BARRIER REEF

PART I. THE DISTRIBUTION, ABUNDANCE AND DISPERSAL BY SEABIRDS OF PISONIA GRANDIS

BY T. A. WALKER

PISONIA ISLANDS OF THE GREAT BARRIER REEF

PART II. THE VASCULAR FLORAS OF BUSHY AND REDBILL ISLANDS

BY T. A. WALKER, M. Y. CHALOUPKA, AND B. R. KING.

PISONIA ISLANDS OF THE GREAT BARRIER REEF

PART III. CHANGES IN THE VASCULAR FLORA OF LADY MUSGRAVE ISLAND

BY T. A. WALKER

ISSUED BY

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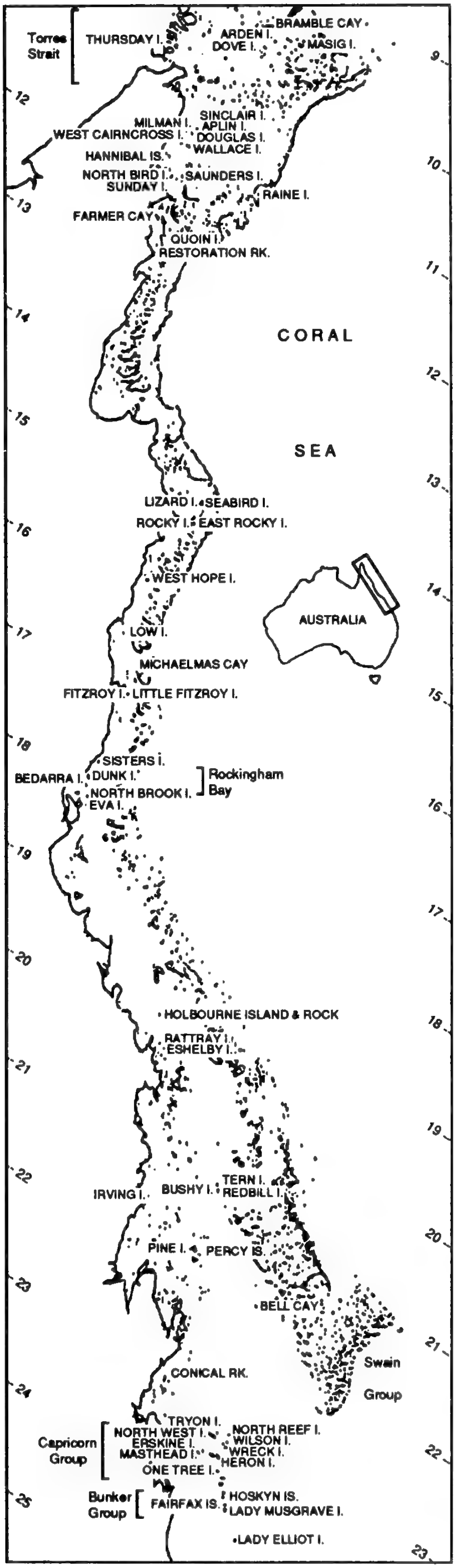
JULY 1991



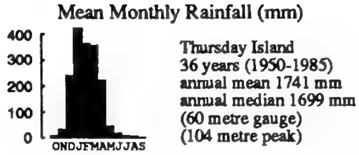
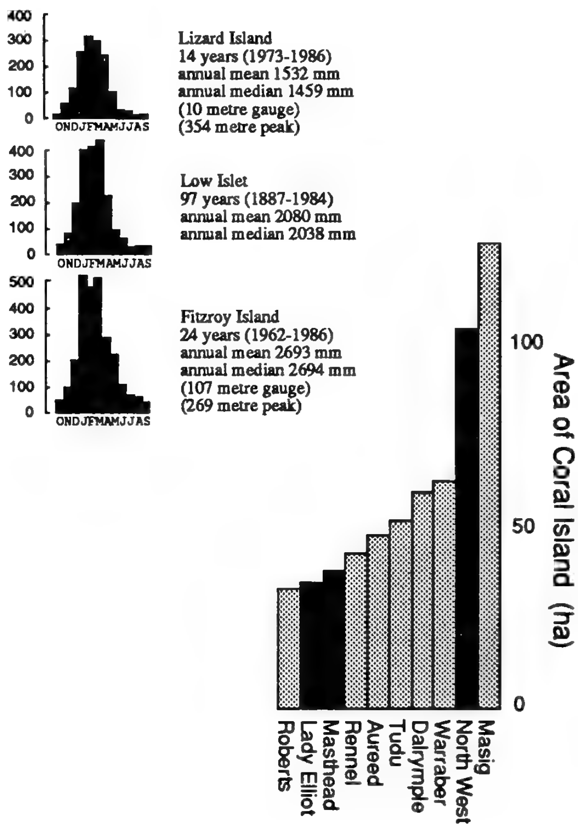
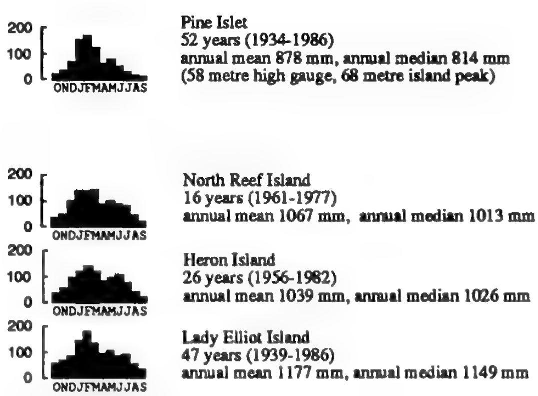


Figure 1-1. The Great Barrier Reef showing localities referred to in the text. Mean monthly rainfall data is illustrated for the four cays and the four rocky islands where records are available. Sizes of the ten largest cays on the Great Barrier Reef are shown below - three at the southern end (23 -24S) and seven at the northern end (9-11S).





PISONIA ISLANDS OF THE GREAT BARRIER REEF

PART I. THE DISTRIBUTION, ABUNDANCE AND DISPERSAL BY SEABIRDS OF PISONIA GRANDIS

BY

T. A. WALKER

ABSTRACT

Pisonia grandis was located on forty-four Great Barrier Reef islands from literature reports and during field surveys between 1983 and 1989. The abundance and maximum dimensions of *Pisonia* were measured for most islands. The highest trees are 16-18 m which is much lower than the 30 m trees reported elsewhere in the Indo-Pacific region. Less than 160 ha of *Pisonia* forest is present in total and 94% is concentrated on cays on the southern Great Barrier Reef especially on North West Island. Northern islands have greater floristic diversity and with rare exception *Pisonia* appears unable to form forests there. Possible reasons for this are discussed. Sixteen species of birds were observed with *Pisonia* fruits attached to their feathers and the primary dispersal agents are identified as the Black Noddy *Anous minutus* and the Bridled Tern *Sterna anaethetus*. The distribution of *Pisonia* is closely associated with the distribution of colonies of these two seabirds. Destruction of *Pisonia* by human activities has been significant since European settlement but relatively minor compared to that elsewhere throughout its range.

INTRODUCTION

Pisonia grandis R. Br. is a remarkable tree of Indo-Pacific islands between the latitudes of 24°N and 24°S. Its unusual features have fascinated botanists since Rumphius (1750) and island cultures have assigned it a variety of roles from culinary to that of sacred plant not to be possessed on penalty of death (Stemmerik 1964). A tall attractive species with large leaves, smooth bark, buttress-like roots and spreading canopy it often forms a shady forest characterised by near absence of undergrowth and other trees. *Pisonia grandis* occurs almost entirely on small islands supporting colonies of seabirds or imperial pigeons (Ridley 1930, St. John 1951, Airy Shaw 1952, Stemmerik 1964). This unique distribution has been attributed both to the spread of seeds by birds and to enhancement of growth by bird guano (Airy Shaw 1952, Stemmerik 1964).

Pisonia grandis forest on coraline substrate tends to produce a rich peat-like acidic humus overlaying phosphate rock (Fosberg 1957). Consequently this forest has been cleared for agriculture (particularly coconut) or phosphate mining on most islands throughout the Indo-Pacific (Fosberg 1974, 1983; Manner *et al.* 1985). The Great Barrier Reef is one region where islands with uncut *Pisonia* forests remain. It has been suggested that phosphatic cay rock requires the presence of seabird guano and *Pisonia* humus for its formation (Fosberg 1957) and *Pisonia* therefore has

Department of Environment and Heritage, PO Box 5391, Townsville 4810, Australia.
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considerable historical importance in generation of commercial Indo-Pacific rock phosphate deposits. The presence of phosphatic cay rock would also indicate past abundance of *Pisonia* where it is presently absent or scarce.

The Great Barrier Reef province (GBR) extends across fifteen degrees of latitude from 9°S to 24°S (Fig.1-1) and contains approximately 950 islands. Most are rocks and islands of continental origin. Approximately 160 coral cays occur (the term "cay" is used here in its correct sense for true islands and does not include submerging sandbanks) and of these all except twenty-five are sited along the northern half of the GBR (9°S to 18°S). The most studied cays are the southernmost fifteen: the Capricorn and Bunker Groups and Lady Elliot Island. These cays are wooded and their often extensive *Pisonia grandis* forests and vegetation have been described in detail (see references in note 13 on page 8). The only other wooded cay on the southern half of the GBR, Bushy Island, is also forested with *Pisonia grandis* (Part II) . The situation on these cays has sometimes led to a belief that *Pisonia grandis* is a common or dominant species on cays of the GBR (Hopley 1982) however *Pisonia* forest has rarely been described elsewhere on the GBR (MacGillivray 1852, Domm 1977) and with one or two exceptions the few reports of this species on northern islands describe small amounts of low or stunted trees.

The present appraisal of the distribution and status of *Pisonia grandis* along the GBR is presented in response to commercial pressure to clear forest for tourism developments and airstrips on these small islands. Results of an extensive survey of GBR islands for *Pisonia grandis* are described with particular reference to its association with seabird colonies.

ISLAND SURVEYS

Four hundred and seventy GBR islands were examined for *Pisonia grandis* and avifauna from 1983 to 1990 (Fig.1-2). Investigations varied from comprehensive surveys of several days duration to observations from a vessel without landing. Further observations were made during aerial overflights of the GBR. Small amounts of *Pisonia grandis* were undoubtedly overlooked but it is considered that all significant stands south of 15°S were examined. Islands north of 15°S were visited less extensively and while information for these islands is incomplete it is considered reliable for forests of *Pisonia grandis*. Several botanists and naturalists with wide geographical

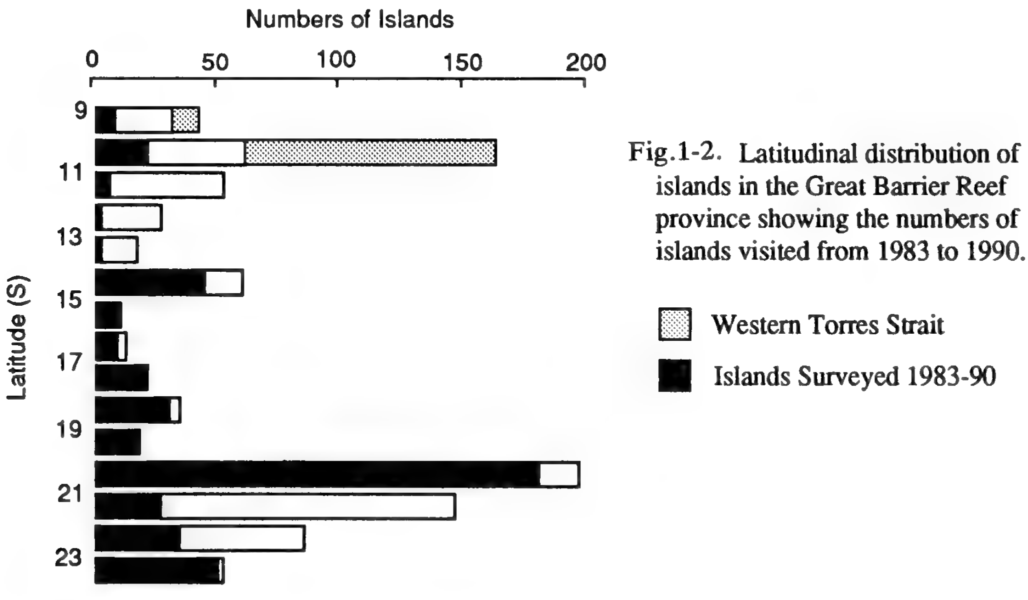

Fig.1-2. Latitudinal distribution of islands in the Great Barrier Reef province showing the numbers of islands visited from 1983 to 1990.

experience along the GBR advised that no other locations for *Pisonia* were known to them (personal communications from S. Domm, B. King, C. Limpus, R. Buckley, H. Heatwole, D. Stoddart, G. Batianoff, E. Hegerl and A. Taplin).

Heights of trees were estimated using an inclinometer. Circumferences of trees were measured at the narrow region between basal root expansion and multiple trunk divergence. In large trees this region is often about a metre above the ground and was descriptively referred to as the "waist" by Cribb (1969). The areas covered by *Pisonia grandis* on each island were estimated from field measurements or determined from aerial photographs or published island maps. Areas were estimated for canopy cover of *Pisonia* forest including the canopies of interspersed trees of other species. Some measurements are approximate because of the brief time available during island visits or because of difficulties associated with distinguishing *Pisonia grandis* from other species on aerial photographs. The trees of greatest height and girth were searched for but not necessarily located on every island. For those islands not visited some published height estimates have been accepted without confirmation. The study has progressed over seven years potentially allowing significant changes in dimensions to occur since the early measurements were taken.

Vegetation species lists were compiled for several islands during the *Pisonia* surveys. Roughly half of the plant species were identified by sight and specimens of the remainder were collected for subsequent identification or confirmation of identity at the Queensland Herbarium. Some taxa were not satisfactorily resolved. *Abutilon* specimens are assigned to *A. asiaticum* var. *australasicum* as this is the only species identified from Australia by Fosberg (1988). *Boerhavia* species were identified according to the Flora of Australia (Bureau of Flora and Fauna 1984) however Fosberg (1988) considers that neither of the two GBR species identified by this key occur in Australia. Records have therefore been assigned to *Boerhavia repens* L. with the assumption that segregation is likely following further detailed examination. Records of *Lepturus repens* may include representatives of the recently described *L. stoddartii* (Fosberg 1988).

DISTRIBUTION AND ABUNDANCE OF PISONIA

Of the 950 or so islands of the GBR region the present field investigation and literature survey could locate only forty-four islands where *Pisonia grandis* occurs. Table 1 summarises the distribution and abundance of *Pisonia* and includes estimates for populations of the two main avian dispersal agents identified in following sections. The following island descriptions are numbered and refer to corresponding note numbers in the final column of Table 1-1.

1) Masig Islet is the larger of the two Yorke Islands and is referred to as Yorke Island on some maps. It is the largest coral cay on the GBR (Fig.1-1) and the Australian continental shelf and is inhabited by approximately 200 people. A five-hour search of the forest and woodland in November 1988 located only two *Pisonia grandis* trees in the centre of the cay beside the airstrip. Further isolated specimens might have been overlooked. The nature of the pre-existing vegetation cleared to make way for the airstrip and its present bordering *Casuarina* forest is unknown but the size of the existing *Pisonia* trees suggests they could pre-date the airstrip and be remnant from a larger stand.

2) MacGillivray (1852) described Arden Island as "low and sandy, covered with tall bushes and a few clumps of trees (*Pisonia grandis*)". Surveys of this uninhabited cay in 1987-88 yielded 53 species of plants (Tables 1-2,1-3) but *Pisonia grandis* was not present. The vegetation is dominated by large deciduous *Gyrocarpus americanus* trees which have a close resemblance to *Pisonia*

Table 1-1. Maximum heights (m), circumferences (m) and abundance of *Pisonia grandis* on Great Barrier Reef cays and rocky islands. Colonies of Black Noddy *Anous minutus* and Bridled Tern *Sterna anaethetus* are also shown (+ breeding colony <500 birds; ++ breeding colony 500-10,000 birds; +++ breeding colony 10,000-200,000 birds; ++ or + denotes large or small roosting population or known past breeding colony).

Island	Cay	Max. Ht.	Max. Circ.	*A. minutus*	*S. anaethetus*	Status of Pisonia
Masig I.	+	12.0	5.3	-	-	Two adjacent trees beside airstrip clearing (1)
Arden I.	+	-	-	-	-	Reported in 1848, not present in 1988 (2)
Dove I.	+	4.0	1.9	-	+	One isolated tree near beach in grassland (3)
Sinclair I.	+			-	-	<0.1 ha (R. Buckley, A. Taplin, pers. comms.)
Milman I.	+			-	-	Some amongst rainforest (A. Taplin, pers. comm.)
Aplin I.	+			-	-	Small amount on shingle bank (Buckley, pers. comm.)
Douglas I.	+	16.0	7.0	+	-	About 2.5 ha of *Pisonia* forest dominates cay (4)
West Cairncross I.	+	19.0	10.0	+	+	About 20 large trees amongst rainforest (5)
Wallace I.	+	8.0		++	+	0.02 ha thicket on grassy cay (King *et al.* 1989)
West Hannibal I.	+	9.0	2.5	-	+	2 trees amongst *Pemphis* on eastern tail of cay rock
East Hannibal I.	+	8.0	3.2	+	-	5 trees on sandy shingle bank within dense *Pemphis*
North Bird I.	+	13.0		++	-	Few in 1 ha *Erythrina* forest (King & Limpus 1985)
Farmer Cay	+	4.0		++	+	Small woodland with *Pisonia* (King and Limpus 1990)
Quoin I.	-	5.0		++	+	0.2 ha stunted thicket on rock (King & Buckley 1985)
Seabird I.	-	1.2	0.2	++	+	1 guano covered shrub on central rise on rocky soil
East Rocky I.	-	1.8	0.4	+	+	1 shrub at summit amongst other shrubs and trees
Rocky I.	-	18.0	10.5	++	++	About 1.5 ha forest on coral sand and on hillside (6)
West Hope I.	+	10.0	3.5	-	+	<0.1 ha, two stands among other trees and thickets
Low Isles	+			-	+	*Pisonia* collected in 1973, not seen in 1988 (7)
Little Fitzroy I.	-	10.0	4.2	-	+	15 trees below vine forest along north face on rock
North Brooke I.	-	8.5	2.3	-	++	2 trees on sand at north end in mixed forest (8)
Eva I.	-	10.0	6.0	-	+	Several trees and shrubs on rock in mixed forest
Holbourne I.	-	5.5	1.0	-	-	0.5 ha narrow strand forest, trees on coral sand
Holbourne Rk.	-	1.5	0.3	-	+	One stunted shrub growing on rock (Walker 1989b)
Rattray I.	-	1.5	0.7	-	-	Windshorn clump of 7 main trunks on western sand
Eshelby I.	-	7.0	2.7	-	++	About 0.5 ha of stands and scattered trees (9)
Tern I.	-	4.5	1.2	-	+	7 low trees in small *Ficus obliqua* thicket on hilltop
Bushy I.	+	13.0	6.0	++	-	2 ha of mature *Pisonia* forest dominates cay (10)
Redbill I.	-	3.0	0.6	-	+	<20 plants on rock in *Ficus obliqua* thicket (11)
Percy Isles	-			-	?	Possibly specimens on rocks off Pine Islet (12)
Conical Rk.	-	0.5	0.3	-	-	Stunted shrub in rock crevice is sole woody plant
North Reef I.	+	4.0	0.4	+	-	2 young trees among *Tournefortia*, *Scaevola* (13a)
Tryon I.	+	13.0	6.4	+	+	6.5 ha of *Pisonia* forest over most of cay (13c,d)
North West I.	+	17.0	9.0	+++	-	94 ha of *Pisonia* forest over most of cay (13b,e)
Wilson I.	+	9.0	3.3	+	+	0.7 ha *Pisonia* forest among *Pandanus* (13b,f)
Wreck I.	+	9.0	2.6	+	+	0.5 ha of *Pisonia* forest in centre of cay (13c,g)
Heron I.	+	13.0	7.0	+++	-	6.5 ha forest and through developed areas (13b,h)
Erskine I.	+	2.5	1.0	+	+	0.1 ha stunted thicket in mixed shrubs (13c,i)
Masthead I.	+	15.0	6.0	+++	+	27 ha of *Pisonia* forest over most of cay (13b,j)
One Tree I.	+	7.0	2.2	++	++	0.5 ha in 6 windshorn thickets on shingle (13b,k)
East Hoskyn I.	+	7.0	1.6	+	+	0.6 ha windshorn *Pisonia* forest on shingle (13b,l)
West Hoskyn I.	+	14.0	3.8	++	+	2 ha of *Pisonia* forest on lee side of cay (13b,l)
East Fairfax I.	+	12.0	11.0	+	+	1.5 ha of remnant *Pisonia* forest on shingle (13b,m)
West Fairfax I.	+	12.0	9.0	+	+	1.3 ha of *Pisonia* forest on shingle and sand (13b,m)
Lady Musgrave I.	+	13.0	7.5	++	+	7 ha of *Pisonia* forest over much of cay (13b,n)
Lady Elliot I.	+	10.0	3.5	+	+	Remnant stand of 11 large trees, shrubs (13c,o)

(see text for notes 1-13)

grandis when branches are bare of foliage and seeds during the dry season. It seems likely that MacGillivray misidentified *Gyrocarpus americanus* as he visited during the dry season. The irregular trunk bases are expanded with massive above-ground roots, there is coppice shooting from fallen branches and trunks, the wood is soft and brittle and the bark is light-coloured and smooth: characteristics remarkably similar to those of *Pisonia grandis*. The presence of *Pisonia* 140 years ago cannot be completely discounted because the island is occasionally or periodically burned by the nearby islanders and the tallest trees (presently *Gyrocarpus*) have been felled for years by government officers when they reached the height of the navigation light tower.

3) Dove Island is an uninhabited sand cay dominated by *Imperata cylindrica* grassland as a consequence of annual burning by the inhabitants of nearby islands. Stands of low trees occur and a solitary *Pisonia grandis* specimen is present beside the beach. This is the only wooded Torres Strait cay where Bridled Tern nesting has been confirmed to date.

4) The highly developed *Pisonia* forest on Douglas Island is discussed on page 14. There were no seabirds nesting during the survey in October 1988 but the observation of eight dead Black Noddies and the spread of white excreta indicated the presence of a nocturnal roosting population.

5) MacGillivray (1852) described Cairncross Island as "... covered in the centre with tall trees ... These large trees *Pisonia grandis* form very conspicuous objects from their great dimensions, their smooth, light bark, and leafless, dead appearance. Some are from eighty to one hundred feet in height, with a circumference at the base of twenty feet." These height estimates conflict with the more likely contemporary value of 58 feet (17.4 m) given for the island trees by Stokes (1846). In October 1848 T. H. Huxley (J. Huxley 1935) also recorded Cairncross Island as ".. well wooded, the most conspicuous objects being the white naked Pisonia trees". In 1988 there were roughly twenty large *Pisonia grandis* trees on the western (large) Cairncross Island and none on the eastern island. These trees were a minor component of a well developed forest dominated in height (20 m) by *Garuga floribunda*, *Ficus virens* and *Gyrocarpus americanus*. In October the cay was very dry and the leafless branches of these three deciduous species and *Pisonia* protruded above the leafy canopies of *Manilkara kauki* and other lower species of trees. The *Pisonia* trees are old and appear to be surviving with little or no vegetative spread or growth of seedlings. There were indications of some nocturnal Black Noddy roosting.

6) Rocky Islet has the second highly developed *Pisonia* forest on the northern GBR. Phosphate rock is widespread but the forest differs from that at Douglas Island because burrowing shearwaters prevent accumulation of a thick humus layer. The forest is protected behind the lee side of a high island ridge and forms a pure stand on the lowland calcareous sand but mixes with other species near to and upon the rocky hillside. There is extensive *Pisonia* growth on non-calcareous substrate but this does not reach the stature or girth of trees on the coraline substrate. Thousands of Black Noddies roost in the forest at night.

7) The Queensland Herbarium in Brisbane has a record of *Pisonia grandis* collected at Low Isles by S. Everist in 1973. It was not observed in other vegetation surveys of the sand cay in 1973 (D. Stoddart, pers. comm.) or in 1983 or 1988. If the 1973 record is correct the species has apparently disappeared or is present only on shingle banks in the mangrove complex (Woody Island).

8) Some confusion occurs in the Rockingham Bay area (approx. 18°S) where *Pisonia inermis* is reported by Bentham (1870). Cribb (1969) considered this to be *Pisonia grandis* and discussed the likelihood that the specimen was collected from an island in the bay rather than from the mainland.

Table 1-2. Terrestrial vascular flora of northern cays where *Pisonia grandis* is recorded, Part 1: Species also naturally occurring or naturalized on southern cays. Species presence on the 16 wooded southern cays is shown for comparison. (Partial list for Masig Island.)

	Northern Cays									Southern Cays															
	Masig	Arden	Dove	Cairncross (west)	Douglas	Wallace	Hannibal (west)	Hannibal (east)	West Hope	Bushy	North Reef	Tryon	North West	Wilson	Wreck	Heron	Erskine	Masthead	One Tree	Hoskyn (west)	Hoskyn (east)	Fairfax (west)	Fairfax (east)	Lady Musgrave	Lady Elliot
Abutilon asiaticum	+	+		+	+	+	+		+	+		+	+	+	+	+	+	+	+	+	+	+	+	+	+
Achyranthes aspera	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Amaranthus viridis	+	+	+									+	+			+						+	+	+	+
Bidens pilosa	+		+	?							+	+	+			+		+		+		+	+	+	+
Boerhavia repens	+	+		+	+	+	+		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Caesalpinia bonduc	+	+	+	+			+	+	+				+							+		+		+	
Canavalia rosea	+		+	+			+		+					+		+		+	+	+	+	+		+	+
Cassytha filiformis	+	+	+	+			+		+	+	+	+	+	+	+	+	+	+							
Casuarina equisetifolia	+	+		+		+	+			+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Catharanthus roseus	+																								+
Celtis paniculata				+	?				+			+	+			+		+							
Cenchrus echinatus	+											+	+	+	+	+	+	+				+		+	+
Cocos nucifera	+	+	+				+		+	+	+	+	+	+	+	+				+		+		+	+
Cordia subcordata	+	+	+	+		+	+		+	+		+	+	+		+		+							
Crinum pedunculatum	+								+	•						+		+							
Cyperus rotundus		+																						+	+
Dactyloctenium aegyptium				+		+	+								+		+								
Diplocyclos palmatus				+	+				+											+					+
Eleusine indica	+											+	+			+		+		+		+	+	+	+
Emilia sonchifolia				+					+																+
Euphorbia atoto	+	+	+	+			+					+	+	+	+	+	+	+	+	+					+
Euphorbia cyathophora	+															+									+
Euphorbia hirta	+	+											+												+
Euphorbia tannensis	+				+	+	+			+		+	+	+	+	+	+	+	+	+		+		+	+
Ficus obliqua					?		?					+	+					+							
Ficus opposita	+											+	+	+	+	+	+	+		+	+	+	+	+	+
Ipomea macrantha				+	?		+		+	+		+	+	+	+	+		+	+	+		+		+	+
Ipomea pes-caprae	+	+	+	+	+	+	+		+	+	+	+	+		+	+		+	+		+	+	+	+	+
Lantana camara	+																								+
Lepturus repens	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Pandanus tectorius	+	+	+	+					+	+	+	+	+	+	+	+		+	+	+		+	+	+	+
Pipturus argenteus	+	+										+	+			+		+							
Pisonia grandis	+		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Portulaca oleracea						+				+	+	+			+	+			+		+	+	+	+	+
Rhynchelytrum repens	+																							+	+
Salsola kali	+	+	+		+	+	+			+		+				+		+	+	+		+			+
Scaevola sericea	+	+	+	+		+	+		+	+	+	+	+	+	+	+	+	+	+	+		+			+
Sesuvium portulacastrum	+		+	+	+	+	+	+	+	+								+	+					+	
Sophora tomentosa		+	+	+					+	+			+			+	+	+	+	+					
Spinifex sericeus	+					+	+					+	+			+	+	+	+					+	+
Sporobolus virginicus	+	+	+	+	+				+	+	+	+	+	+	+	+	+	+						+	+
Stachytarpheta jamaicensis	+																								+
Suriana maritima	+	+	+	+	+							+	+		+	+		+		+					
Thuarea involuta	+	+		+					+	+	+	+	+	+	+	+	+	+	+	+	+	+		+	+
Tournefortia argentea	+	+	+	+					+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Tribulus cistoides	+	+	+	+	+					+		+	+	+	+	+	+	+	+	+				+	
Tridax procumbens	+		+							+															+
Triumfetta repens		+		+		+				+												+			+
Vigna marina	+	+							+									+							
Wollastonia biflora	+		+	+			+		+	+		+	+	+	+	+	+	+	+	+		+			+

Table 1-3. Terrestrial vascular flora of northern cays where *Pisonia grandis* is recorded, Part 2: Species not naturally occurring or naturalized on southern cays. (Partial list for Masig Island)

	Masig	Arden	Dove	Cairncross (w)	Douglas	Wallace	Hannibal (w)	Hannibal (e)	West Hope
Abrus precatorius		+	+	+	+		+		+
Bauhinia binata							+		
Boerhavia sp.		+							
Bulbostylis barbata		+							
Calotropis procera			+						
Cananga odorata				+					
Cansjera leptostachya				+					
Canthium vaccinifolium				+					
Capparis arborea		+							
Capparis lucida	+	+	+	+	+		+		?
Capparis quiniflora				+					
Capparis sarmentosa					+				
Capparis separia									+
Capparis spinosa		+	+						
Capparis sp.	+			+					
Carissa laxifolia		?		+			+		
Cayratia acris		+							
Cayratia cardiophylla		?			+				+
Cayratia saponaria				+			+		
Cayratia trifolia		+			+		+		
Cayratia sp.	+							+	
Cleome viscosa	+		+	+	+	+	+	+	
Clerodendrum inerme	+	+	+	+	+		+		+
Cochlospermum gillivraei	+								
Colubrina asiatica	+	+	+	+			+		+
Commelina lanceolata		+	+						
Commelina undulata				+					+
Commelina sp.	+			+	+				
Cynanchum carnosum									+
Cyperus pedunculatus	+	+		+					
Cyperus scaber	+								
Cyperus stoloniferus		+							
Cyperus sp.	+		+						
Derris trifoliata									+
Digitaria ctenantha									+
Diospyros maritima	+	+		+	+		+		+
Dodonae viscosa	+			+					
Drynaria rigidula									+
Drypetes australasica				+			+		
Endospermum medulosum									+
Erythrina sp.				?	?		+	+	
Eupomatia?									+
Eugenia reinwardtiana				+					
Exocarpus latifolius				+			+		+
Ficus drupacea					+		+		
Ficus virens	+	+		+					
Ficus sp.	+			+	+	+	?		
Flagellaria indica	+			+	+			+	+
Ganophyllum falcatum				+					+
Garuga floribunda				+			+		
Glycosmis pentaphylla				+	+		+		+
Guettardia speciosa	+			+			+		+
Gyrocarpus americanus		+		+	+		+		
Hibiscus tiliaceous	+	+	+				+		
Imperata cylindrica	+		+						
Ipomea aquatica		+							
Ipomea nil			+						
Ipomea sp.	+				+		+	+	
Josephinia imperatricus	+	+	+	+					
Leucaena leucocephala			+						
Macaranga tanarius	+								
Malaisia scandens				+					
Manilkara kauki	+	+	+	+	+	+	+		
Micromelum minutum				+	+		+		
Mimusops elengi				+					+
Morinda citrifolia	+		+		?				+
Mukia maderaspatana		+							
Olax pendula				+			+		
Operculina riedeliana						+			
Opilia amentacea				+					
Pachygone ovata				+					+
Pandorea pandorana				+					
Panicum trichoides					+				
Passiflora foetida	+						+		
Pemphis acidula		+		+	+		+	+	+
Phyllanthus amarus				+					
Phyllanthus novaehollandiae		+							?
Phyllanthus reticulatus				+					+
Phyllanthus tenellus							+		
Phyllanthus sp.						+			
Pleomele angustifolia	+			+					
Platycerium bifurcatum									+
Pongamia pinnata									+
Portulaca australis		+	+				+		+
Premna serratifolia	+	+	+	+	+	+	+		+
Proiphys amboinensis	+		+	+					
Ptychosperma elegans				+					
Salacia chinensis			+						
Sida spinosa		+							?
Schefflera actinophylla									+
Scyphiphora hydrophyllacea			+						
Solanum seaforthianum									+
Solanum torvum									+
Solanum viridifolium		+					+	+	
Solanum sp.									+
Spermacoce sp.			+						
Suaeda australis								+	+
Tacca leontopetaloides	+	+	+	+					
Terminalia catappa	+								+
Terminalia melanocarpa				+					
Terminalia muelleri		+					+		
Terminalia sp.	+			+		+		+	
Thespesia populnea	+				+	+		?	+
Thespesia populneoides							?		
Tinospora smilacina		+							+
Turrea brownii			+				+		
Vitex negundo		?							+
Vitex trifolia		+							
Vitex ovata	+	?				+			
Xenostegia tridentata				+		+	+		+

Banfield (1908), a long-time resident of Dunk Island, described in detail the "murderous" nature of *Pisonia brunoniana* the "bird-lime tree", "Upas-tree" or "Ahm-moo" of the natives which "counts its victims by the thousand each season." He stated that "On some of the islands where the tree is plentiful numbers of pigeons meet a dreary fate every season." A subsequent long-time resident of nearby Bedarra Island noted that "Banfield's Upas tree... *Pisonia umbellifera* is not found in the islands themselves, only on the mainland" (N. Wood in Porter 1983). The Bureau of Flora and Fauna (1984) records *Pisonia umbellifera* from near Mission Beach and at Clump Point, both mainland localities in Rockingham Bay. The present survey of islands in Rockingham Bay located only two *Pisonia grandis* trees on sand at the northern end of North Brook Island (site of a major Torresian Imperial-Pigeon colony) but found *Pisonia aculeata* vines on Sisters Island further north. The source of Banfield's observations remains a mystery.

9) Eshelby Island is a 50 m high, 11.5 ha granite rock with the most extensive growth of *Pisonia grandis* on rocky soil on the GBR. *Pisonia* clumps are scattered amongst other trees and shrubs throughout the island. Eshelby Island supports the largest Bridled Tern colony in eastern Australia (Walker and Hegerl 1986).

10) The *Pisonia* forest and vegetation of Bushy Island (4.5 ha) is identical to that of the Capricorn and Bunker cays 330 km to the south (Part II) . Phosphatic cay rock and a nocturnal Black Noddy roosting population of many thousands are present (Walker 1987). There are no known roosting or nesting colonies of this species for a distance of 840 km to the north. Bridled Terns and other seabirds probably nested at the cay prior to interference from human activities.

11) Redbill Island is a steep 1 ha rock with upper slopes covered by a dense low thicket of *Ficus obliqua* containing several interspersed *Pisonia grandis* (Walker 1989a, (Part II) . No other woody plants are present. Wallace and Lovell (1977) list *Ficus opposita* as the only woody plant on the isle in 1973. Although it is possible for *Pisonia grandis* to have arrived and grown to 3 m in the subsequent fourteen years the species may have been initially overlooked. The widely scattered distribution of *Pisonia* specimens pressed upon by *Ficus* thicket suggests a long period of residence. The *Pisonia* are the same height as the *Ficus* thicket and appear to be partially dependent upon it for protection from salt-laden wind.

12) Bentham (1870) reported collection of *Pisonia grandis* from the Northumberland Islands by Robert Brown. The only islands in this group that were visited by Brown are three of the Percy Isles namely Middle Percy Island, South Percy Island and Pine Islet (Flinders 1814). The first two of these islands are large and did not have *Pisonia grandis* recorded in recent vegetation surveys (S. Domm, pers. comm.; G. Batianoff, pers. comm.). The third, Pine Islet, is a small rock which has not been surveyed since Brown's visit. *Pisonia grandis* specimens may be present but the species was unknown to the resident lighthouse keepers.

13) For the most recent descriptions of the vegetation and seabirds of the Capricorn Group, the Bunker Group and Lady Elliot Island consult the following: (a) Walker and Domm 1986, Walker and Ogilvie 1988*, Walker 1989c; (b) Hulsman 1984; (c) Heatwole 1984, Chaloupka and Domm 1985, Heatwole and Walker 1989; (d) Cribb 1979*, Hulsman *et al.* 1991a; (e) Cribb 1969a*, Hulsman and Walker 1991a; (f) Cribb 1965*, Walker and Hulsman 1991a; (g) Hulsman *et al.* 1991b; (h) Gillham 1963, Smith and Heatwole 1985, Kikkawa and Boles 1976*; (i) Walker and Hulsman 1989*; (j) Hulsman *et al.* 1984*, Dale *et al.* 1984; (k) Heatwole *et al.* 1981*; (l) Cribb 1972*, Walker and Hulsman 1991b; (m) Cribb 1986*, Walker *et al.* 1991; (n) Elsol 1986*, pages 31-38*, Hulsman and Walker 1991b; (o) Walker 1986, Walker 1989d* [* denotes inclusion of a vegetation map].

The Capricorn-Bunker cays support most of Australia's *Pisonia* forest and are the principal breeding sites for the two most abundant seabirds on the GBR, the Wedge-tailed Shearwater and the Black Noddy. North West Island in particular supports 60% of the GBR *Pisonia* and over 50% of the biomass of breeding seabirds on the GBR.

In addition to the records of Table 1 there are possible stands of *Pisonia grandis* on Restoration Rock and Sunday Island (Fig.1-1). At both islands *Pisonia grandis* was tentatively observed from a vessel, white guano appeared to be present on the leaves and Black Noddies were flying over the water nearby (King 1983 and pers. comm.).

Pisonia grandis occupies less than 160 ha on GBR islands. Further distribution sites undoubtedly remain to be found particularly in northern regions but they are unlikely to consist of more than isolated specimens or small stands. *Pisonia grandis* is not known to grow on the mainland and the only other Australian records are for two or three small islands in the Gulf of Carpentaria including the type locality, Pisonia Island. Geographically therefore Australia has a total of less than 170 ha of *Pisonia grandis*. The value is increased by inclusion of territories in the Coral Sea (north-east Herald Cay, south-west Coringa Cay, south-east Magdelaine Cay) and Indian Ocean (Christmas Island, Cocos Islands) that support stands of *Pisonia grandis* (St. John 1951, Airy Shaw 1952, Hindwood *et al.* 1963, Stemmerik 1964).

An estimated 30-40 ha of *Pisonia grandis* was cleared for phosphate rock mining on Lady Elliot Island and East Fairfax Island in the 1890s and on Holbourne Island in the 1920s (Ellis 1936, Cribb 1986, Walker 1989b,d). There has been relatively little recovery of *Pisonia* at these islands. Phosphate mining on Lady Musgrave Island and North West Island was less extensive (Ellis 1936) and partial or complete reforestation has occurred. An additional 4 ha of *Pisonia grandis* has been cleared for buildings and roads at Heron Island. There is no historical information on the abundance of *Pisonia* forest on the GBR cays to the east of Torres Strait. These northernmost cays appear to provide a suitable growth site although the vegetation has been altered for centuries by seasonal burning and cultivation.

Most *Pisonia grandis* along the GBR occurs on coral cays or on cay-like areas of coral substrate fringing continental islands(Table 1-1).Highly developed forest is restricted to coraline substrate. Growth on non-coraline substrate was recorded at Quoin Island, Seabird Island, Rocky Islet, East Rocky Islet, Little Fitzroy Island, Eva Island, Holbourne Rock, Eshelby Island, Tern Island, Redbill Island and Conical Rock. These specimens were mostly healthy but the greatest height reached was no more than 10 m.

AVIAN DISPERSAL OF PISONIA GRANDIS

The anthocarps of *Pisonia grandis* have a sticky resinous exudate that binds them to bird feathers or other surfaces (Banfield 1908, Cribb 1969). Birds may contact fruits in trees or on the ground below. Frequently the whole infructescence will attach to a bird restricting its ability to fly or feed. Panicles accumulate on the ground in thick mats following storms. On the Capricorn-Bunker islands thousands of entangled seabirds die in years when *Pisonia* fruiting is heavy. The main species affected are the Black Noddy *Anous minutus* and the Wedge-tailed Shearwater *Puffinus pacificus* (Hulsman and Walker 1991a). In one example beneath a tree on Lady Musgrave Island forty-five dead or dying Black Noddies were trapped in an area of 75 square metres (April 1984). Inhabitants of some Indo-Pacific islands are reported to use the sticky infructescence of *Pisonia grandis* to catch birds (Ridley 1930, Stemmerik 1964). The fruits can trap insects (Banfield 1908)

and may be so adhesive that even tree snakes are immobilized (Ridley 1930). The fruits are not eaten by birds but the flowers are sometimes eaten by the Silvereye *Zosterops lateralis* (Heatwole *et al.* 1981) and at Little Fitzroy Island the flowers were visited by the nectar-feeding Yellow-bellied Sunbird *Nectorinia jugularis*.

In the present study sixteen species of birds were observed with attached *Pisonia grandis* fruits (Table 1-4). An Australian Reed Warbler *Acrocephalus australis* was previously reported with fruits attached (Kikkawa 1970) but such vagrant species are too rare to be of significance to dispersal. Another GBR species the Rufous Night Heron *Nycticorax caledonicus* is reported to carry *Pisonia* fruits elsewhere (Ridley 1930) and domestic poultry and feral chickens may disperse fruits about an island (Cooper 1948) although not between islands.Two species from Table1-4, the Black Noddy and Bridled Tern, have the potential to be important dispersal agents of *Pisonia* between islands. Other species either have small populations on the islands, are sedentary, do not normally enter *Pisonia* forest or are sufficiently agile to avoid most contact with fruits. Seabirds and Torresian Imperial-Pigeons are the only species with large populations mobile between GBR islands.

The migratory Torresian Imperial-Pigeons are not considered to be important dispersal agents because they do not feed in *Pisonia grandis* trees and rarely nest in *Pisonia grandis*. These birds are reported to suffer many casualties from *Pisonia* fruits (Banfield 1908, Roughley 1936) but only one was seen with attached fruits during the present study. Torresian Imperial-Pigeons do not visit southern GBR islands but some nests are built in *Pisonia* at Douglas Island and possibly at Farmer Cay so these pigeons could play a minor role in local seed dispersal in the north.

Most waders and seabirds avoid entering forests. The main exceptions are Black Noddies which nest in trees and Wedge-tailed Shearwaters which nest in burrows. Shearwaters are able to nest in

Table 1-4. Characteristics of Great Barrier Reef birds seen with attached Pisonia fruits.

		Observed carrying Pisonia	Population size on the GBR	Mobility between islands	Entry to forest habitat
Anous minutus	Black Noddy	+++	+++	+++	+++
Puffinus pacificus	Wedge-tailed Shearwater	+++	+++	+	+++
Sterna anaethetus	Bridled Tern	++	++	+++	+++
Ducula spilorrhoa	Torresian Imperial Pigeon	+	+++	+++	+++
Sula leucogaster	Brown Booby	+	++	+++	+
Tringa brevipes	Grey-tailed Tattler	+	++	+++	+
Arenaria interpres	Ruddy Turnstone	+	++	+++	+
Pluvialis dominica	Lesser Golden Plover	+	+	+++	+
Larus novaehollandiae	Silver Gull	+	+	+++	+
Egretta sacra	Eastern Reef Egret	+	+	++	+++
Geopelia humeralis	Bar-shouldered Dove	+	+	+	+++
Zosterops lateralis	Silvereye	+	+	+	+++
Rallus philippensis	Buff-banded Rail	+	+	+	+++
Megapodius reinwardt	Orange-footed Scrubfowl	+	+	+	+++
Halcyon sancta	Sacred Kingfisher	+	+	+	+++
Coracina novaehollandiae	Black-faced Cuckoo-Shrike	+	+	++	++

large numbers under *Pisonia grandis* forest because there is little undergrowth to block their entry. Black Noddies and shearwaters frequently carry *Pisonia* fruits. Shearwaters are unlikely to be important dispersal agents as they are not known to visit GBR islands other than their breeding site each year. Brown Boobies nest under *Pisonia* forest on the Fairfax Islands and East Hoskyn Island but are not known to enter forest or woodland elsewhere along the GBR making them unlikely seed dispersal agents other than between these three islands. Fruits were commonly found attached to Brown Booby chicks that were raised beneath *Pisonia* trees.

Bridled Terns and Silver Gulls nest under vegetation on many islands. The largest Silver Gull population on the GBR occurs at the southern end on the Capricorn-Bunker Islands (Walker 1988a). Gulls have been observed with various types of seeds attached to their feathers and may be significant carriers of plant species amongst the fifteen coral cays in this area. Many gulls commute between these islands on a daily basis. There is a good correlation between the mean number of gulls at each cay and the number of plant species that are dispersed by birds (Heatwole and Walker 1989). Despite this local correlation Silver Gulls are unlikely to be important distributors of *Pisonia* along the GBR. They have small populations at islands, are relatively skilful in avoiding *Pisonia* fruits and show less propensity for long distance travel along the GBR than the seabirds which disperse seasonally.

Black Noddies and Bridled Terns are clearly the primary dispersal agents for *Pisonia grandis* on GBR islands(Tables 1-1,1-4).Before examining this relationship two other potential *Pisonia* dispersal mechanisms should be noted for completeness. First, White-bellied Sea-Eagles *Haliaeetus leucogaster* and Ospreys *Pandion haliaetus* were found on occasion to carry and place living *Pisonia* branches in nests built on the ground. Rooting or shooting was not observed from the branches on these occasions but should be possible under certain conditions. Second, *Pisonia* trees toppled into the sea by shoreline erosion had floated to the other side of two cays where they took root and produced shoots. Six such specimens were growing on the beach at Bushy Island in 1989. Neither of these dispersal processes is likely to be significant to colonisation of new islands by *Pisonia* because sea-eagles build their nests from vegetation collected on the same island as the nest and because *Pisonia* does not float well and can probably tolerate only brief immersion in seawater.

ASSOCIATION OF PISONIA WITH SEABIRD COLONIES

All except two GBR islands with Black Noddy breeding colonies are vegetated with *Pisonia grandis*. Nesting occurs primarily within *Pisonia* stands and associated trees except at North Bird Island, Farmer Cay, Baird Island and Chapman Island where mangroves are used (King and Limpus 1985, King and Limpus 1991, King 1991) and at Lady Elliot Island where *Tournefortia argentea* and *Casuarina equisetifolia* are used (only a few *Pisonia grandis* trees remain at Lady Elliot Island in the middle of a tourist resort). Black Noddies roost on several cays but uncommonly on continental islands. Roughly half of the islands with *Pisonia grandis* presently support Black Noddy populations(Table 1-1)Most of the remaining *Pisonia* islands support Bridled Tern colonies. Bridled Terns are infrequently observed with attached fruits and many islands with Bridled Tern colonies do not have *Pisonia grandis*.

Black Noddies breed on eight Coral Sea cays to the east of the GBR (Hindwood *et al.* 1963). The largest colonies nest in *Pisonia grandis* on the three cays where it grows (forest or stands to 6-8 m). The other colonies nest in *Tournefortia argentea* at cays devoid of other species of trees. There is also a report of several nests on ground herbage at Turtle Island, an unwooded Coral Sea cay (Hill 1984).

Relatively few islands with *Pisonia grandis* do not presently support populations of Black Noddies or Bridled Terns(Table 1-1)Conical Rocks are small spray-exposed seabird roosting rocks where the only woody plant is one *Pisonia grandis* shrub sheltering in a crevice. Rattray Island is the closest island to Eshelby Island which has the largest Bridled Tern colony on the east coast. Holbourne Island has no nesting seabirds but commercially mined phosphate rock deposits are evidence of previous occupation (Walker 1989b).

Pisonia grandis is absent from approximately 170 seabird breeding islands on the GBR. On many nesting cays and small rocky islands the environment is too harsh to support growth of trees. Coconuts, for example, have been persistently planted on unwooded cays (eg. Bramble Cay, Raine Island, Michaelmas Cay, Swain Group) without success. *Pisonia grandis* is intolerant of direct salty wind and even on well wooded cays does not colonise the strand environment. *Pisonia* forest is wind-pruned or stunted at the windward sides of Capricorn-Bunker Islands in the absence of a windbreak of strand trees such as *Casuarina, Pandanus* or *Tournefortia.*

Seabirds are essential to *Pisonia grandis* for seed dispersal and their guano may confer competitive advantages to the plant (see page 14). In return Black Noddies are benefited by provision of tree nesting sites and suitable leaves for nest construction. Black Noddy nesting is primarily in *Pisonia* forest but the nests are preferentially placed in *Celtis, Ficus* and certain other less abundant trees within the forest (Hulsman *et al.* 1984; Dale *et al.* 1984; Walker, pers. obs.). This may facilitate access through the more open canopies of these species or may be a behaviour to reduce the nest and clutch loss that results from the characteristic windthrow of *Pisonia* branches or trees. There is no apparent advantage to Bridled Terns from association with *Pisonia.* Detrimental effects of *Pisonia grandis* on seabirds include high mortality from entanglement in fruits and eventual displacement of species that require open ground for nesting.

Pisonia may assist Wedge-tailed Shearwaters by provision of a ground surface bare of obstructive vegetation so long as they colonise the site prior to hardening of the phosphate rock which inhibits their tunnelling. In return, burrowing shearwaters protect *Pisonia* forest from commercial mining by reworking the sand and preventing formation of a humus layer and phosphate rock. In the absence of shearwater burrowing the formation of phosphate rock on many Capricorn-Bunker Islands would have led to their certain mining and defoliation in the 1890s (Ellis 1936). It should be noted that phosphate rock is present on several unwooded seabird nesting cays on the GBR. Some, including Bramble Cay, Raine Island, Michaelmas Cay and Bell Cay, were mined or were leased for phosphate mining. There is no evidence that *Pisonia* was previously present on these cays and this seems unlikely in view of the harsh treeless environment. *Boerhavia repens* L. tends to dominate and form meadows at these major ground-nesting seabird colonies and may be involved in formation of phosphate rock. This herb is in the same family as *Pisonia,* is dispersed by seabirds and can form a brown humus under favourable conditions (Walker 1988b).

PISONIA STATUS ON SOUTHERN CAYS

On Capricorn, Bunker, Lady Elliot and Bushy Islands *Pisonia grandis* displaces other vegetation to form a climax forest. This dominance is achieved by vegetative extension rather than by spread of seeds. Frequent windthrow of branches and trunks is facilitated by the shallowness of the root system and the brittle nature of the wood. Extensive regions of parenchyma throughout the wood give it a weak, spongy structure consisting of two-thirds water (Cribb 1969). Fallen branches and trunks take root and produce rows of coppice shoots thereby advancing into surrounding habitat. The closed canopy extends to the ground and the advance of the canopy shades out other plants.

This process of lateral expansion of groves and trees is illustrated in sequential aerial photographs at Lady Musgrave Island (Elsol 1986; Part III). Herbs and shrubs, notably *Wollastonia biflora* and *Abutilon asiaticum* establish in clearings and under canopy breaks following windthrow of *Pisonia*. Comparison of sites at Masthead Island showed a negative correlation between mean *Pisonia* height and density of other species of trees (Hulsman *et al.* 1984, Dale *et al.* 1984) suggesting that *Celtis paniculata* , *Ficus opposita* and other trees also require disturbance of *Pisonia* to establish. The forest floor is dark, bare sand or humus where the canopy is unbroken. Locusts completely stripped the *Pisonia* foliage on west Fairfax Island in 1986 allowing sunlight to penetrate to the forest floor. An impenetrable metre-high thicket of *Wollastonia* and other species rapidly developed but when visited eight months later the canopy had regrown, the forest floor was again in shade and the undergrowth thicket was dead.

Pisonia grandis seedlings are infrequently seen on Capricorn-Bunker islands but sometimes germinate in clusters on the forest floor following rain. *Pisonia grandis* is itself shade intolerant (Gillham 1963, Airy Shaw 1952) and these clusters of seedlings disappear after germination. The only native species in the Capricorn-Bunker islands with any potential to displace *Pisonia* might be *Caesalpinia bonduc* which has slowly expanding thickets on west Hoskyn and Lady Musgrave Islands. These climbing thickets are very dense and have grown over and covered *Pisonia* trees. Seeds of the strangler fig *Ficus obliqua* can also germinate on *Pisonia grandis* but this appears to be an uncommon occurrence.

PISONIA STATUS ON NORTHERN CAYS

Large *Pisonia grandis* forests occur only on coral cays of the southern GBR. These cays are larger and more advanced than cays elsewhere but are equalled or surpassed by the large cays to the east of Torres Strait at the northern end of the GBR(Fig.1-1).The vegetation of the Torres Strait cays (9°S-11°S) has been modified by the indigenous people with possible destruction of *Pisonia grandis* but there are no reports (and no investigations) of phosphate rock which would indicate previous forest (Fosberg 1957). With the exception of the most remote island, Bramble Cay, large seabird colonies are also non-existent on Torres Strait cays presumably as a result of egg harvesting and hunting (Walker 1988b).

The islands from 11°S to 22°30'S have been traditionally visited by mainland aborigines seeking nesting turtles, birds and other food but unlike the Torres Strait Islanders they did not settle and cultivate food. One hunting technique was to set fire to the end of an island and spear the fleeing mammals and reptiles that emerged onto the beach at the other end. This method would be of no value on cays as they do not harbour large mammals or reptiles (at least not any more). A non-anthropogenic explanation seems necessary to explain the general absence of *Pisonia grandis* forest on the northern wooded cays many of which are colonised by seabirds.

Unlike southern cays there is no characteristic forest type on northern cays. Plant diversity is higher and floristic differences between individual islands are greater. Tables 1-2 & 1-3 compare the terrestrial vascular flora (above high tide) of northern cays where *Pisonia grandis* occurs or was previously reported (vegetation lists are not available for all cays). The vegetation of these islands is generally representative of other northern cays.

West Cairncross Island and Douglas Island are of particular note because they are only 8 km apart but have major forest differences. West Cairncross Island supports one of the most diverse and highly developed forests of any cay on the GBR. Few coral islands have an equivalent species

diversity and even fewer have an equivalent diversity of native species. Cairncross Island was well vegetated with *Pisonia grandis* in 1848 (MacGillivray 1852) but the species has apparently not been able to expand or displace the other vegetation in subsequent years. Douglas Island on the other hand is the only northern cay where mature *Pisonia* forest was found to occur. This forest is remarkably similar in appearance to *Pisonia* forests on the southern cays. Few other trees occur within the forest (notably *Ficus*) which has little undergrowth and thick peat-like humus overlaying phosphate rock. The main differences from southern forests are the presence of lianas on *Pisonia* trees and the presence of different species of trees and shrubs fringing the forest and cay. Douglas Island and the continental Rocky Islet are important because they demonstrate that there are no climatological barriers to formation of *Pisonia* forest on northern islands and its scarcity is therefore controlled primarily by biological factors.

Plant species on southern cays are incapable of competitively displacing *Pisonia grandis* but this is not necessarily so on northern cays. At least six times more species of trees are present on cays in the north (Table 1-3) with the result that *Pisonia* experiences wider competition. At Cairncross Island *Pisonia* is struggling against other species while nearby at Douglas Island it maintains an unchallenged dominance.

GROWTH OF PISONIA GRANDIS

The pattern of distribution and growth of *Pisonia grandis* suggests that there is no simple explanation for the floristic dominance on southern cays and the scarcity on northern cays. Several factors, each of small effect alone, more likely combine to lower the ability of *Pisonia* to compete with other vegetation and reduce the probability of forest dominance. Contributing factors may include low dispersal frequency, effects of guano, precipitation patterns, diversity of plant competitors, insect grazing, genetic variation and mycorrhizal associations.

Dispersal Frequency

Dispersal of *Pisonia grandis* seeds to locations other than to seabird nesting or roosting sites is probably an uncommon event. Black Noddies and Bridled Terns are never seen at the mainland unless blown in by tropical cyclones (Campbell 1918, Griffin 1972, Walker pers. obs.) and there is little evidence of nomadic roosting by these species on islands. Bridled Terns migrate overseas following breeding with apparently little visitation to other GBR islands. Black Noddies also migrate, some overseas, some to established roosting colonies elsewhere on the GBR and a number remain at the breeding sites in certain cases. If the distribution of *Pisonia grandis* was due solely to seabird dispersal the species should become established in non-seabird areas over a period of time as a result of uncharacteristic dispersal events (eg. cyclone scatter of seabirds). This does not seem to occur (Table 1) indicating that factors additional to dispersal are involved.

Guano and Growth Factors

It has been suggested that *Pisonia grandis* may require bird guano for growth and that when the supply of guano is interrupted by avian abandonment of sites the trees eventually disappear (Airy Shaw 1952). This is unlikely as there are examples of growth in the absence of guano on the GBR (Table 1-1) and elsewhere (St. John 1951, Airy Shaw 1952, Stemmerik 1964, Spicer and Newbery 1979). There is no absolute requirement for guano if the soil contains sufficient nutrients but its presence may nevertheless confer a competitive advantage. This could result from either a positive effect on *Pisonia grandis* or a negative effect on other species or both. High levels of guano are

poisonous to many species and "guano burning" of shrubs and herbs is often visible beneath noddy nests. Tree seedlings might be particularly susceptible and many unable to establish in abundant guano. The shallow roots of *Pisonia grandis* have a unique mycorrhizal association (page 17) which might function in protection from, or utilisation of, high guano levels in the surface substrate.

It has been suggested that *Pisonia* seeds might require the presence of animal matter to germinate and that the species is indirectly carnivorous by trapping insects, birds and animals in its fruits to fertilise the soil (Banfield 1908). Seeds have no special growth requirements and will germinate without animal matter or guano (M. Chaloupka, pers. comm.) but the possibility of some small nutrient benefit to growth from addition of carrion at certain islands cannot be dismissed.

Precipitation

Lower rainfall on southern cays (Fig.1-1) may favour *Pisonia grandis* which has an exceptionally shallow root system adapted to utilise near-surface moisture and avoid contact with the water tables of cays. The cay water table is usually saline from seawater intrusion except when flushed by rain. Trees with deep root systems may be weakened by contact with saline water on cays with low rainfall. Forks in large *Pisonia* trees sometimes collect and retain rainwater for months following rain. *Pisonia grandis* requires moderate rainfall for growth and expansion but is adapted to withstand prolonged dry conditions and sheds its leaves in such years. It is reported to have been abundant prior to phosphate mining on Nauru where the mean annual rainfall is only 203 mm (Manner *et al.* 1985). There is also a report of *Pisonia* trees at an old village site on Vaugo Island near Port Moresby (Papua) where the annual rainfall is only 70 mm (Bell 1969). *Pisonia* may be better able to cope with wide seasonal or inter-annual variations of rainfall than many other trees. On northern cays the higher rainfall also improves growth conditions for competitors intolerant of salt or guano by washing these substances from the foliage and soil.

Diversity of Plant Competitors

Growth of *Pisonia* will be influenced by the nature of other species competing for space, light and nutrients. Keith (in Airy Shaw 1952) states that *Pisonia grandis* is intolerant of both competition and shade. The greater floristic diversity on northern GBR cays can be primarily attributed to their proximity to mainland vegetation compared with the southern cays, to their histories of anthropogenic interference and burning (unknown for southern cays prior to European arrival) and to their large populations of Torresian Imperial-Pigeons. Higher rainfall may also contribute to diversity. The most striking of these factors is the effect of Torresian Imperial-Pigeons.

Torresian Imperial-Pigeons migrate to Australia in spring and depart in late summer. They nest in island colonies of up to 200,000 birds particularly in mangrove trees and depart each day to feed on fruit on the mainland. Upon their return vast numbers of viable seeds are excreted on the islands. Torresian Imperial-Pigeons are found on virtually all wooded northern islands in summer. The main plant families consumed include Lauraceae, Moraceae, Arecaceae, Anonaceae, Burseraceae, Oleaceae, Chrysobalanaceae, Sapindaceae, Combretaceae, Rutaceae, Verbenaceae, Solanaceae and Myristicaceae (Crome 1975a,b, Frith *et* al. 1976). Other foods include *Manilkara kauki* and *Celtis* species. Torresian Imperial-Pigeons do not visit the southern cays and apart from stragglers the southernmost colony is at Irving Island (21°27'S). In addition to endozoochory the daily commuting of hundreds of thousands of Torresian Imperial-Pigeons increases the probability of dispersal of diaspores that attach externally to bird feathers. Most plants with epizoochores are encountered

close to the ground rather than in the tree canopy but Torresian Imperial-Pigeons also feed in low shrubs such as *Solanum torvum* and *Vitex* species.

Another aspect of competitive interaction is the timing of forest development. If a mature, dark *Pisonia grandis* forest can develop before the arrival of seeds of strongly competitive species then the later arrivals may be unable to establish. Soil modifications associated with *Pisonia* forest might also enhance its relative competitiveness. The pH of coral sand is about 8.3 decreasing to 7.0 as normal humus is incorporated but *Pisonia* humus ranges from pH 6.0 to 4.0 (Fosberg 1957, 1974). Such an effect might operate at Douglas Island where *Pisonia grandis* has generated a thick humic layer but is less likely at most Capricorn-Bunker islands where burrowing Wedge-tailed Shearwaters rework the sand and prevent formation of a humus layer.

Insect Grazing

Pisonia grandis forest occurs on isolated islets relatively impoverished with insect or animal grazers that might otherwise prevent its formation on larger land masses. Occasional invasions by locusts or other insects blown from the mainland cause severe defoliation of *Pisonia* (see previous Fairfax Island example, also Musgrave 1925) but high insect populations do not persist on small islands (Heatwole *et al.* 1981). The proximity of northern cays to the mainland and the occurrence of north-west monsoonal winds presumably results in more frequent insect invasions than on southern cays and island flora derived from the adjacent mainland should be more resistant to insect damage than *Pisonia grandis* which has relatively less exposure to pests.

Genetic Variation

Pisonia grandis has an initial advantage over most trees dispersing to small islands because one plant can spread asexually by vegetative means in the absence of other individuals or pollinators. Growth on some GBR islands is undoubtedly clonal. Vegetative reproduction is also advantageous in relatively homogeneous predictable habitats such as occur at seabird cays (ie. calcium carbonate substrate, guano, salt air). Carlquist (1974) noted that *Pisonia grandis* ranges over wide stretches of the Pacific without even subspecific differentiation among remote islands thus testifying to the effectiveness of bird dispersal in reintroducing genes that swamp local incipient speciation. If this is correct the absence of genetic replenishment amongst *Pisonia grandis* growing at sites no longer inhabited by seabirds might also result in loss of vigour and eventual displacement over a long time period.

While it is probable that *Pisonia grandis* is genetically homogeneous throughout its range the possibility of the existence of distinct strains or varieties cannot be dismissed. The small sterile cultivated variety *Pisonia alba* (Airy Shaw 1952, Stemmerik 1964, Fosberg 1974) is well known and conflicting reports on the effects of guano as a growth factor might have arisen from observations of strains with differing requirements. The *Pisonia* forests on high Indo-Pacific islands (*Pisonia grandis* is reported at altitudes of 1200 m, Stemmerik 1964) may be genetically distinct. It is notable that *Pisonia grandis* trees on the GBR are only half of the height, 30 m, that they have been measured elsewhere although they attain the same maximum diameter of 3-4 m (Stemmerik 1964, Fosberg 1974). Tall and short varieties may be involved as no nutritional deficiency is apparent on large GBR sand cays where the central trees are protected from salt wind. Growth to 30 m would confer no advantage to Capricorn-Bunker trees but may be necessary elsewhere in the Indo-Pacific to avoid shading by tall species.

Mycorrhizal Association

Mycorrhizae, the symbioses between fungi and plant roots, are nearly universal in terrestrial vascular plants (Malloch *et al.* 1980). Two basic types of mycorrhizae occur (characteristics summarized by Malloch *et al.* 1980, Connell and Lowman 1989). Vesicular-arbuscular mycorrhizae (VAM) are formed by a small number of physiologically unspecialised and ubiquitous fungi with over 80% of land plants. VAM penetrate the root tissue forming intracellular vesicles and arbuscles. Ectomycorrhizae (EM) do not normally penetrate root cells but form a sheath around the epidermis isolating the root from the soil. EM are less widespread than VAM but the thousands of EM fungal strains are more highly plant specific. Unlike VAM the EM have an extensive mycelium in the soil that appears capable of decomposing organic matter and absorbing organic nitrogen.

A notable feature of insular floras is the high component of non-mycorrhizal families (Pirozynski 1983). Plants that form EM are particularly rare on Pacific Islands possibly as a result of infrequent co-dispersal of phycobiont and mycobiont (Malloch *et al.* 1980, Pirozynski 1983, Schmidt and Scow 1986). VAM associations are widespread at Heron Island (Peterson *et al.* 1985) and presumably elsewhere on GBR cays which are all relatively close to the mainland. VAM fungi are probably essential for the establishment of vegetation on beach dunes and may survive seawater immersion and attach to vegetative propagules of host plants (Trappe and Schenk 1982, Koske and Gemma 1990). *Pisonia grandis* forms a unique type of EM with morphological characteristics unlike that found in other plants (Ashford and Allaway 1982 and 1985, Ashford *et al.* 1988). This unique association adds a second dimension to mechanisms influencing the distribution of *Pisonia* because factors affecting the distribution, survival and genology of the fungus must also be considered. This is particularly important if, as with other EM, the fungus has few phycobionts other than *Pisonia grandis*. Failure to form the EM association or infection with a fungal strain less suited to the environment presumably weakens the competitive ability of *Pisonia*. At Cousin Island and Bird Island (Seychelle Islands, Indian Ocean) the *Pisonia* growing on coral sand were strongly infected with EM but *Pisonia* from granitic soil at 50 m altitude were poorly infected or were not infected at all (Ashford and Allaway 1985).

Forests dominated by a single species of tree are thought to develop from a highly efficient association with a species-specific EM mycobiont (Malloch *et al.* 1980, Connell and Lowman 1989). Such dominance is more likely on poor soils where the nutrient scavenging ability of EM mycelia is most advantageous. Once an EM plant species achieves dominance it may be difficult for other species to establish due to scarcity of spores of VAM fungi or suitable specific EM mycobionts (Connell and Lowman 1989, Alexander 1989). These spores should be scarce in the absence of suitable phycobionts and might also be toxically inhibited by the dominant EM in the soil. EM associations are uncommon in the tropics. Applying the hypothesis to *Pisonia grandis* the development of forest would require co-dispersal of suitable mycobiont spores with the *Pisonia* seeds. Suitable spores are unlikely to occur at islands where *Pisonia* is absent. At Heron Island *Pisonia grandis* is the only species with EM (Peterson *et al.* 1985). EM spores are often wind-dispersed although dispersal by seabirds is a further possibility in this particular case. If the fungus is relatively specific to *Pisonia grandis* then successful forest formation may require seabird transport of both the seeds and the fungal spores thus greatly reducing the probability of establishment away from seabird colonies. The only weakness with the mycorrhizal dominance hypothesis is that substrates at seabird colonies are usually considered to be rich in nutrients (although the addition of bird guano may not increase the levels of all micronutrients required for plant growth on a carbonate substrate). Impoverished substrate is not, however, important if *Pisonia* achieves

dominance mainly by competition for light (vegetative expansion) rather than by competition for soil nutrients. The mycorrhizal hypothesis gives a feasible explanation of why *Pisonia* forest dominates at Douglas Island while nearby at Cairncross Island *Pisonia* is a minor component of the forest. If an EM-*Pisonia* forest establishes prior to arrival of seeds of competitors it may prevail but if *Pisonia* initially faces strong competition from tall trees the EM dominance may not become established.

An interesting example supporting the mycorrhizal hypothesis is a Brazilian white-sand forest dominated by EM trees. In this forest there were fewer saprophytic fungi and more litter accumulation than in nearby forest on fertile soils where EM were rare (Singer and Araujo 1979). This accords with other work indicating that EM reduce the rate at which saprophytic organisms decompose organic litter in low-nutrient soils (Gadgil and Gadgil 1971, Harmer and Alexander 1985). Despite the addition of seabird guano such a mechanism might contribute to the formation of the thick humus layer under *Pisonia* and hence to generation of phosphate rock.

CONCLUSION

Pisonia grandis is highly adapted to growth at seabird colonies and has developed exceptional morphological and physiological characteristics in association with seabirds and mycorrhizal fungi. It is particularly well adapted to growth on coraline substrate on the Great Barrier Reef although elsewhere in the Indo-Pacific it is dominant on volcanic and other non-calcareous substrates. The geographical distribution in association with tropical seabird colonies is unlike that of any other plant species.

Pisonia grandis is sometimes described as the most common tree on cays of the Great Barrier Reef. This misconception derives from a generalisation of the situation on the Capricorn-Bunker cays where *Pisonia* displaces other vegetation to form a climax forest. *Pisonia grandis* is uncommon elsewhere on Great Barrier Reef islands which have a more diverse flora. At least 18% of Australian *Pisonia grandis* forest has been cleared for mining or island development. The figure could be higher if some Torres Strait islands were forested with *Pisonia grandis* before burning and gardening became routine. This splendid forest type has a sad history of destruction throughout its range on Indo-Pacific islands and its conservation on the Great Barrier Reef depends on location of future tourist developments on environmentally robust continental islands rather than on coral cays.

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PISONIA ISLANDS OF THE GREAT BARRIER REEF

PART II. THE VASCULAR FLORAS OF BUSHY AND REDBILL ISLANDS

BY

T. A. WALKER, M. Y. CHALOUPKA, AND B. R. KING.

ABSTRACT

Vegetation species lists are compared over a sixteen year period at a coral cay and continental island off the east coast of Queensland. A total of thirty-seven species were recorded. These twin islands are of considerable geomorphological and biogeographical importance. Bushy Island supports one of Australia's few forests of *Pisonia grandis* and is floristically identical with the Capricorn-Bunker Islands at the southern end of the Great Barrier Reef.

INTRODUCTION

Coral islands are rare on fringing reefs and with the exception of Redbill Reef (20°58'S; 150°05'S) are restricted to the northern third of the Great Barrier Reef. Such reefs are sometimes considered to be platform reefs incorporating an outcrop of continental rock (Hopley 1982). Redbill Reef (Fig. 2-1) is also unique in that it supports the only wooded coral cay, Bushy Island, on the southern Great Barrier Reef (from 17° to 23°S). Between Bushy Island and Green Island 630 km to the north there are only one or two unstable sandbanks that emerge sufficiently in some years to support herbs. Between Bushy Island and North Reef Island 310 km to the south there are only nine emergent cays supporting a few species of herbs and grasses. The isolation of Bushy Island is remarkable in view of its size and mature forest. Redbill Island is also notable in being the furthest offshore continental island to the east of the Australian coast.

The vegetation of Bushy Island is of considerable interest because it is dominated by *Pisonia grandis* forest (Steers 1938, Wallace and Lovell 1977, Hopley 1982, Walker 1987). *Pisonia grandis* is not known to occur on the Australian mainland and *Pisonia* forest is almost unknown in Australia outside of the Capricorn-Bunker Islands at the southern end of the Great Barrier Reef (Part I).

SPECIES RECORDS

Plants were identified or collected for identification as follows: 26 December 1972 to 4 January 1973, both islands, Wallace and Lovell (1977); 24-25 January 1984, both islands, B. King, A. Taplin and T. Walker; September 1986, Bushy Island, M. Chaloupka; 10 November 1986, Redbill Island, T. Walker; 12 December 1987 (drought conditions), both islands, T. Walker; 30-31 August 1989 (wet conditions), both islands, T. Walker. The results of the floristic surveys are listed in Table 2-1. An additional beach vine, *Canavalia*, was reported in a figure caption to Bushy Island (Hopley 1982, p. 332) but requires confirmation.

Department of Environment and Heritage, PO Box 5391, Townsville 4810, Australia.

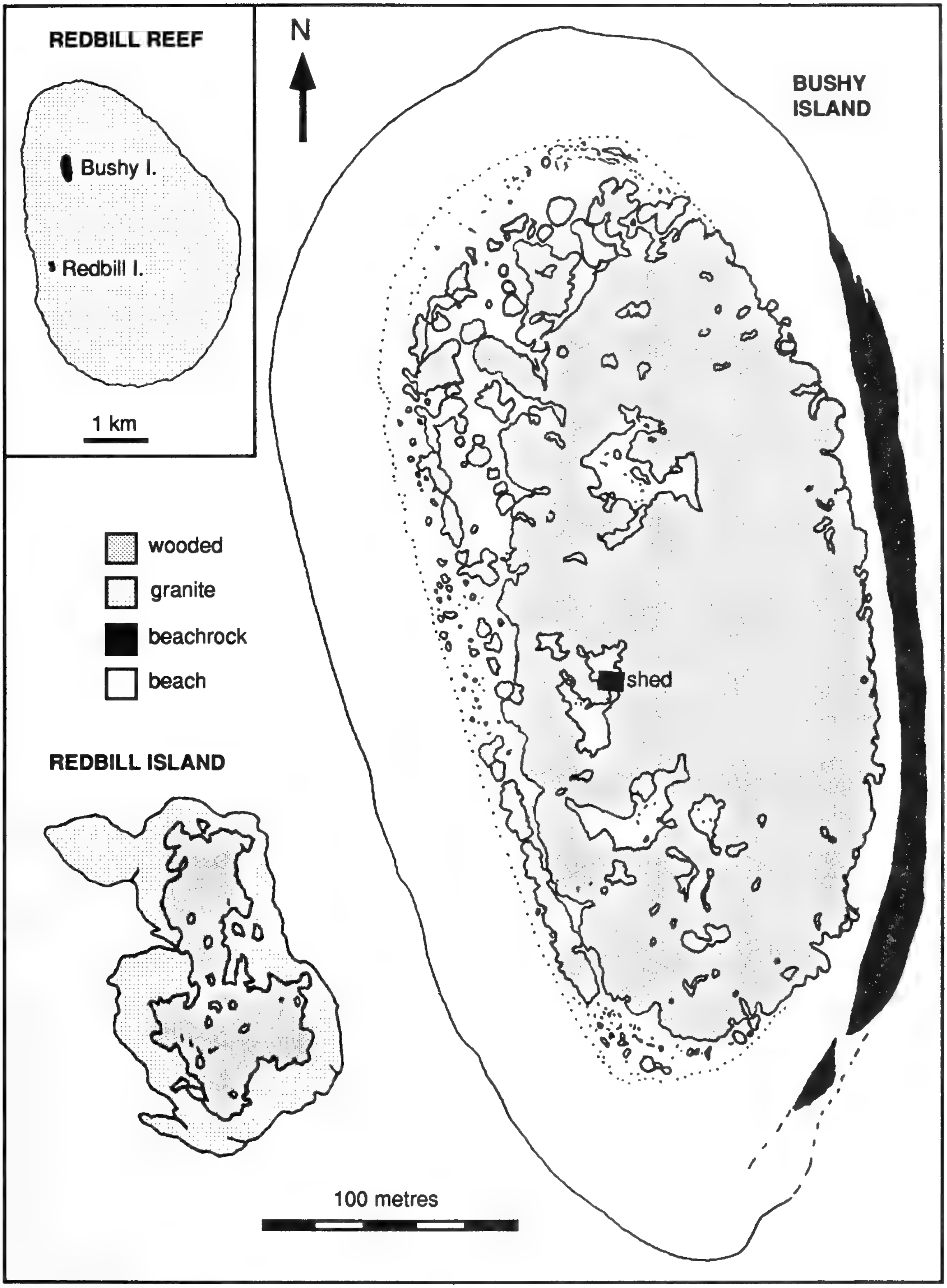

Fig. 2-1. Redbill Reef, Bushy Island and Redbill Island (from 1987 aerial photography by T. Walker). Scales are not precise.

Table 2-1. Floral species lists in different years from Bushy Island and Redbill Island excluding two cultivated species (1973 data from Wallace and Lovell 1977). The number of Capricorn and Bunker Islands (out of a total of 15 including Lady Elliot Island) where each species has been recorded is shown for comparison (Heatwole 1984, Chaloupka and Domm 1985, Cribb 1986, Walker and Ogilvie 1987, Walker unpublished).

Species	Bushy Island					Redbill Island					Capricorn & Bunker Islands
	1973	1984	1986	1987	1989	1973	1984	1986	1987	1989	
Abutilon asiaticum	+	+	+	+	+			+	+	+	14
Cassytha filiformis	+	+	+	+	+						8
Casuarina equisetifolia	+	+	+	+	+						15
Cordia subcordata	+	+	+	+	+						5
Ipomea pes caprae	+	+	+	+	+						11
Pandanus tectorius	+	+	+	+	+						13
Pisonia grandis	+	+	+	+	+		+	+	+	+	15
Salsola kali	+	+	+	+	+						7
Scaevola sericea	+	+	+	+	+						12
Thuarea involuta	+	+	+	+	+	+	+				14
Tournefortia argentea	+	+	+	+	+						15
Tridax procumbens	+	+	+	+	+						1
Triumfetta repens	+	+	+		+						2
Myoporum acuminatum	+							+	+	+	1
Sesuvium portulacastrum	+				-	+					3
Sophora tomentosa	+										6
Sporobolus virginicus	+										10
Vitex trifolia	+										1
Boerhavia repens		+	+	+	+			+	+	+	15
Euphorbia tannensis		+	+	+	+			+		+	13
Ipomea macrantha		+	+	+	+						11
Lepturus repens		+	+	+	+			+	+	+	15
Portulaca oleracea		+	+	+	+		+	+	+	+	10
Cakile edentula		+	+		+						13
Tribulus cistoides		+	+		+			+	+	+	10
Rhynchelytrum repens			+	+	+						1
Plumbago zeylanica				+	+		+[1]	+	+	+	8
Commelina sp.				+							0
Achyranthes aspera					+			+	+	+	15
Passiflora foetida					+			+		+	0
Solanum americanum					+						13
Sonchus oleraceus					+						10
Wollastonia biflora					+						11
Calophyllum inophyllum					+						1
indeterminate weed					+						
Ficus obliqua						+[2]	+	+	+	+	3
Digitaria brownii								+[1]	+[1]	+	0
Total species (37)	18	20	21	20	29	3	5	13	11	13	
Native species (30)	16	17	17	18	22	3	5	12	11	12	
Sea-dispersed species (19)	14	13	13	11	16	2	1	3	3	3	

1. Identification uncertain.
2. Reported as *Ficus opposita* by Wallace and Lovell (1977).

ISLAND FLORAS

Bushy Island has an area of 4.5 ha (above high tide) and rises 2-3 m above high tide and 6-7 m above the reef flat(Fig.2-1).The reef has an area of about 900 ha. The first records of vegetation were reported by Steers (1938) who produced a compass traverse map in 1936. Steers noted that the cay "resembles the sand islands of the Bunkers and Capricorns very closely" and has "fairly close vegetation, including *Pisonia, Tournefortia*, and *Pandanus*. Creeping plants - eg., *Ipomoae* - were also present, as well as *Abutilon*." The species diversity has increased since the first systematic floristic collection was made in 1972-73 and although five species have disappeared a total of fifteen new species have been recorded (Table 2-1).

In August 1989 there was an infestation of locusts at Bushy Island but the vegetation was lush and not yet seriously affected by the pest. Most plant species were abundant. The main exceptions were *Cordia subcordata* (four specimens on the eastern edge), *Tribulus cistoides* (eight small specimens on the western strand), *Rhynchelytrum repens* (restricted to a small clearing at the northern edge of the cay), *Sonchus oleraceus* (a few specimens beside the hut), *Solanum americanum* (three specimens in two separate clearings), *Passiflora foetida* (one small specimen on the north-western strand), *Wollastonia biflora* (one small vine in front of the south-western *Casuarina* grove), *Calophyllum inophyllum* (one 50 cm sapling in the *Casuarina* grove) and an indeterminate weed (possibly *Raphanus* sp., a few immature specimens beside the hut). In addition *Achyranthes aspera, Boerhavia repens, Portulaca oleracea, Salsola kali, Triumfetta repens* and *Ipomea pes-caprae* were not abundant, the latter three being restricted to the western strand. In 1987 the island was very dry and foliage was greatly reduced. Seeds of *Cakile, Triumfetta* and *Tribulus* were presumably present in 1987 although plants were not observed.

The periphery of Bushy Island is continually changing in response to alterations in the direction and strength of prevailing seas. Erosion on one side of the cay is normally accompanied by sand accretion on the other side. In 1936 the underlying beach rock along the western shore was uncovered by erosional processes (map of Steers 1938) while in 1973 this rock was reburied and beach rock on the eastern side of the cay was exposed (map of Wallace and Lovell 1977). In the following year beach rock was uncovered on both the eastern and western sides of the southern part of the cay (Hopley 1981). In 1987 over twice as much beach rock was visible along the eastern beach as in1973 (Fig. 2-1) and a 1-2 metre high sandcliff separated high tide from forest trees which have been toppling onto the beach during the 1980s. This erosion was most extensive in 1989 with many fallen *Pisonia, Tournefortia* and *Pandanus*. Conversely on the western side of the cay sand has accumulated since 1974 to form a wide strand zone. Plant colonisation of this zone has been rapid despite trampling and uprooting by nesting green turtles in summer. In January 1984 hundreds of 40-250 cm high seedlings of *Casuarina equisetifolia* were present in a narrow supra-tidal strip along the southern part of the western strand. Within twenty-two months this strip had grown to a dense 7 m high wall of trees and in 1989 it was fronted by a lower barrier of *Tournefortia* and *Scaevola*.

The centre of Bushy Island is more stable than the margin but has also experienced disturbance in recent decades. Large clearings with fallen *Pisonia* logs have been present since at least 1973 but were not noted in 1936. The clearings appear too discrete to have resulted from indiscriminate cyclone damage but this cannot be ruled out. The forest is devoid of undergrowth or other species except in clearings. Phosphate rock is present with a few pockets of peat-like *Pisonia* humus. A prominent feature within the forest is the presence of incubation mounds and diggings of the Orange-footed Scrubfowl, *Megapodius reinwardt*. The sand mounds are up to three metres high

and the forest floor is a mosaic of pits and tangled *Pisonia* roots uncovered by megapode digging. The continual scratching and digging may inhibit establishment of other plant species in the forest.

Redbill Island lies to the south of Bushy Island with an area of about 1 ha and an elevation of 23 m. The upper slopes are covered with a dense 0.4 ha stunted thicket of *Ficus obliqua* incorporating roughly twenty low *Pisonia grandis* specimens particularly at the edges(Fig.2-1). The thicket is mainly 1-3 m high. The rock and pockets of humus beneath the thicket are bare of undergrowth except for *Plumbago zeylanica*. The lower slopes of the island are mainly bare granite with pockets or specimens of grasses or herbs. The eastern gully is relatively protected and supports the highest diversity of species including two, *Myoporum acuminatum* and *Passiflora foetida*, not present elsewhere on the rock. In 1989 *Tribulus cistoides* and *Passiflora foetida* were represented by one small specimen and two vines respectively while *Euphorbia tannensis* and *Boerhavia repens* were also rare. There has been an apparent increase from three to thirteen plant species at Redbill Island and only one of the thirteen species present in 1986 was recorded in 1973(Table 2-1).This change is too great to be an error from incomplete survey results in 1973. The exposed lower rock slopes may undergo episodic defoliation and recolonisation following storms or drought.

PLANT DISPERSAL AND COLONISATION

More than half of the plant species at Bushy Island are dispersed by the sea. The same is true at Redbill Island despite the absence of a beach suitable for colonisation by strand species. Seeds of the species not capable of arrival by sea can all be dispersed by birds. Three or four species have alternative dispersal mechanisms by wind but in view of the distance from mainland (90 km), the rarity of offshore winds and the properties of the seeds of these species this mode of colonisation seems less likely. The potential for introduction of plants by human activities is discussed in the following section.

Few species of birds are resident at the islands however the dominant plant species, *Pisonia grandis* at Bushy Island and *Ficus obliqua* at Redbill Island, are both dispersed by birds. The first seeds of *Pisonia grandis* were undoubtedly transported to the islands attached to the feathers of seabirds. Black Noddies *Anous minutus* and Bridled Terns *Sterna anaethetus* are the principal dispersal agents of *Pisonia* along the Great Barrier Reef (Part I). Black Noddies have a nocturnal roosting population of many thousands on Bushy Island and Bridled Terns have a summer nesting colony of approximately 200 on Redbill Island (Walker 1987, 1989). The *Pisonia* forest appears to propagate vegetatively but in 1989 a group of seventeen *Pisonia* seedlings to 30 cm high were present behind the south-western *Casuarina* grove.

It is notable that the two islands are only 1.3 km apart but *Ficus obliqua* has not colonized Bushy Island. The absence of fig-eating birds or indeed of any resident land birds from Redbill Island apparently precludes dispersal of *Ficus obliqua* which grows to 12 m high on Capricorn-Bunker cays and can germinate upon and "strangle" *Pisonia* trees. Such growth on a *Pisonia* tree was observed near Bushy Island at Tern Island.

HUMAN INFLUENCES ON FLORA

Redbill Island is an inhospitable rock rarely climbed by visitors whereas Bushy Island has long been popular with tourists and campers. A tour vessel operating from 1984 to 1986 brought over 3,000 people ashore per annum. In the mid 1960s a shelter hut was constructed for tourist day-visitors and this was intermittently occupied by a caretaker until 1988. The forest clearings on

Bushy Island may have been cut by beche-de-mer collectors who used the island as a base for boiling their catch in past years. Another possibility is that the clearings are a result of limited phosphate mining. The latter is suspected by local fishermen but there are no records of a mining lease and no apparent indications of digging in the clearings.

Excluding several coconut (*Cocos nucifera*) trees and pawpaw (*Carica papaya*) planted beside the hut there are six or seven non-native species recorded at Bushy Island (17- 20% of all species). *Cakile edentula* and *Triumfetta repens* are supra-tidal herbs that colonise from floating seeds. The grass *Rhynchelytrum repens* and the weed *Sonchus oleraceus* follow human inhabitation of tropical islands and are accidental introductions by visitors to Bushy Island. *Tridax procumbens* is dispersed widely on islands by wind, people or birds. All species at Redbill Island are native to Australia except *Passiflora foetida* which is dispersed by fruit-eating birds.

COMPARISON WITH OTHER ISLANDS

The only species recorded from Bushy Island that have not been reported on Capricorn-Bunker cays are the vine *Passiflora foetida* and the scrambling herb *Commelina*. *Passiflora foetida* and species of *Commelina* are widespread on cays and rocky islands elsewhere throughout the Great Barrier Reef region(as are all the species inTable 2-1with theexception of*Cakile edentula*and possibly *Plumbago zeylanica, Sonchus oleraceus* and *Rhynchelytrum repens*). The *Calophyllum inophyllum* seedling is probably temporary as the species is an unlikely coloniser at Bushy Island. *Calophyllum inophyllum* seeds wash ashore on Capricorn-Bunker cays but do not successfully germinate or do not survive beyond seedling stage (Cribb 1975). The species composition of Bushy Island is virtually identical to that of the Capricorn-Bunker cays (Table 1) and the species diversity is the same as that of the two Capricorn-Bunker cays of the same size (Table 2). The vegetation structure is also identical consisting of a dominant *Pisonia grandis* forest (up to 13 m high) fringed with pan-tropical strand species.

The floras of Bushy Island and the Capricorn-Bunker Islands differ substantially from those at other Great Barrier Reef islands (Part I). A wide variety of trees, shrubs, vines and herbs not present on the southern cays occurs elsewhere on cays and continental islands. The only other cay with a mature *Pisonia* forest is Douglas Island (east of Cape York Peninsula) which has major differences in the composition of the supporting vegetation.

Table 2-2. Comparison of floristic diversity of Bushy Island with that of the Capricorn-Bunker Islands of equivalent size. Cultivated species and survey data prior to 1968 are excluded. One Tree Island and Fairfax Island data are from Heatwole (1984) and Cribb (1986).

	Bushy	West Fairfax	One Tree
Island area (ha)	4.5	5	4
Range of species numbers in surveys	18-28	21-32	(21)
Total number of species recorded	34	34	30
Range of native species in surveys	16-22	17-21	(19)
Total native species recorded	28	22	22
Sea-dispersed species in surveys	11-15	12-15	(15)

The closest islands to Redbill Reef are Tern Island 6 km to the north-west and Penrith Island 17 km to the south-west. The flora of Tern Island was only partly recorded but at least half of the species inTable 2-1occur there. Tern Island is a steep rock like Redbill Island but is roughly three times larger with three small detached vegetated rocks. At its northern summit there is a small *Ficus obliqua* thicket containing a few *Pisonia grandis* but the isle is mainly vegetated with grasses, herbs, and low shrubs with higher shrub thickets along the top of the ridge. Several species occur that are not present at Bushy or Redbill Islands. One of these is *Sesuvium portulacastrum* which became extinct at Bushy and Redbill Islands but which is present on all four of the Tern Islets (it is the only plant species present on the smallest southern rock).

Penrith Island is 248 ha in area with at least 162 vascular plant species in up to seven identifiable communities including grassland, *Eucalyptus* woodland and mangroves (Batianoff 1987).All species in Table 2-1 were reported at Penrith Island except *Triumfetta repens, Rhynchelytrum repens, Solanum americanum, Cakile edentula, Portulaca oleracea, Pisonia grandis* and *Plumbago zeylanica.* The exceptionally sticky fruits of the latter two species are dispersed throughout Bushy, Redbill and Tern Islands by seabird populations which are absent from Penrith Island.

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PISONIA ISLANDS OF THE GREAT BARRIER REEF

PART III. CHANGES IN THE VASCULAR FLORA OF LADY MUSGRAVE ISLAND

BY

T. A. WALKER

ABSTRACT

The flora of Lady Musgrave Island has progressed from a belt of small strand trees surrounding a central scrub less than a metre high in 1843 to a mature *Pisonia grandis* forest in the 1980s. This succession was interrupted by phosphate mining and severely retarded over seventy years by grazing goat herds. Seven plant species lists recorded between 1927 and 1989 illustrate the changes occurring from natural and anthropogenic processes. 45% of the flora are naturalised alien species. There has been an eight-fold increase in human visitation in recent years but this has not resulted in a significant increase in colonisation by weeds.

INTRODUCTION

Lady Musgrave Island is the second most southerly island (23°54'S, 152°23'E) on the second most southerly reef of the Great Barrier Reef. It is the first island in the Bunker Group and consists of 13 ha (above high tide) of coral shingle, sand and phosphate rock. Lady Musgrave Island is the best example of a Great Barrier Reef island where advancing *Pisonia grandis* forest is displacing other vegetation (Figure 1-1). Substantial areas of vegetation and soil were cleared for phosphate mining in the 1890s and the vegetation was stripped bare by goats released by the miners in 1898 (Ellis 1936).

Over twenty thousand seabirds, primarily Wedge-tailed Shearwater *Puffinus pacificus* and Black Noddy *Anous minutus*, nest on the cay during summer. Less abundant species of ground-nesting terns have been partially displaced by tourists visiting the cay. The island experienced a progressive eight-fold increase in human visitation between 1984 and 1989 elevating it to the position of sixth most heavily visited cay on the Great Barrier Reef. The potential impact of tourists on the vegetation is primarily that of introduction of weeds and other alien species. Summer and winter floristic surveys were carried out on 12 January (dry conditions) and 3 June 1989 (following extensive rain) in order to evaluate vegetation changes that have occurred since previous surveys.

FLORISTIC HISTORY

The earliest description of the island and its flora is that of Jukes (1847) who landed on 7 January 1843: "The beach was composed of coarse fragments of worn corals and shells, bleached by the weather. At the back of it a ridge of the same materials, four or five feet high, and as many yards

Department of Environment and Heritage, PO Box 5391, Townsville 4810, Australia.

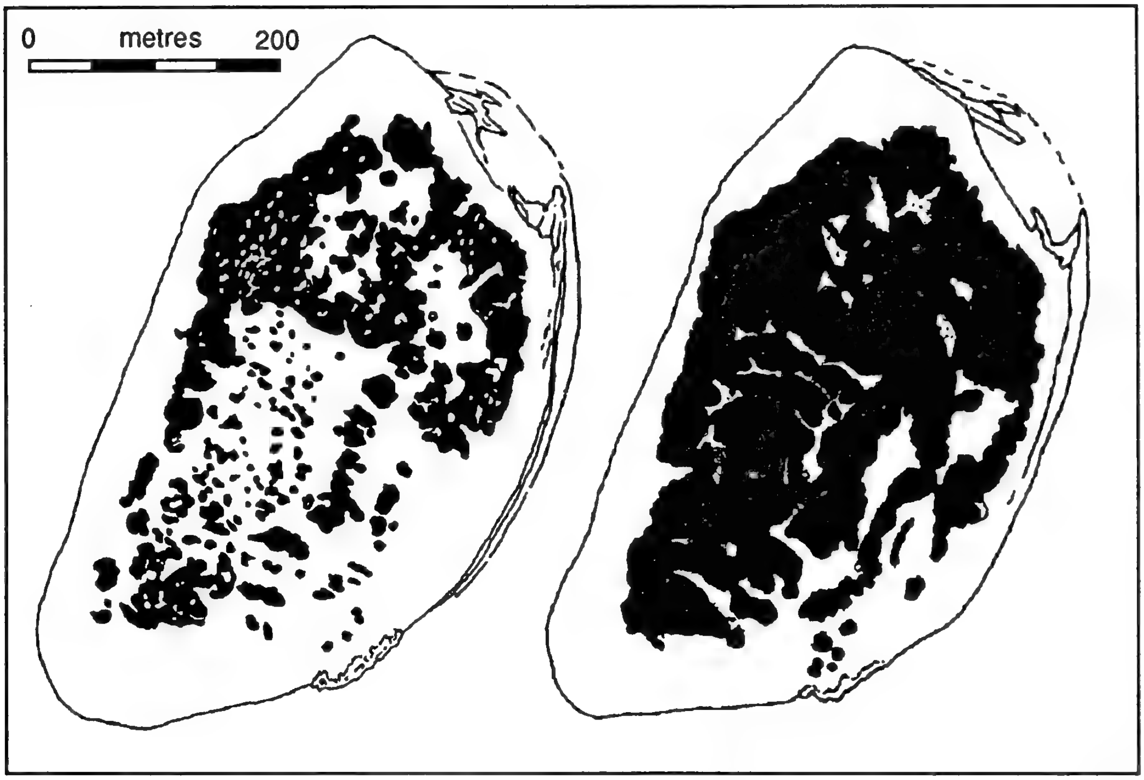

Fig. 3-1. Lady Musgrave Island in 1967 and in 1987 showing the increase in cover by *Pisonia grandis* over twenty years. A few isolated trees were not identifiable from the aerial photography.

across, completely encircled the island, which was not a quarter of a mile in diameter. Inside this regular ridge were some scattered heaps of the same stuff, the whole encircling a small sandy plain. The encircling ridge was occupied by a belt of small trees, while on the plain grew only a short scrubby vegetation, a foot or two in height. The materials of the encircling ridge were quite low and thinly covered with vegetable soil among the trees; but the sand of the central plain, which was dark brown, was sufficiently compact to be taken up in lumps, and a little underneath the surface it formed a kind of soft stone, with imbedded fragments of coral. Some vegetable soil also was found, a few inches in thickness in some places, the result of the decomposition of vegetable matter and birds' dung." Jukes also noted that the trees were "loaded" with the nests of Black Noddies and that shearwaters were abundant.

More recently, floristic surveys have been carried out on seven occasions commencing in 1927 (Tbls. 3-1 3-2; Fig. 3-2). The first survey in November 1927 reported only eleven species growing (MacGillivray and Rodway 1931). At that time up to 300 goats (23 per ha) had removed all small trees, shrubs, herbs and grasses with the exception of a few sessile plants growing too close to the ground to be grazed (Nebe 1928, Napier 1928, MacGillivray 1928, MacGillivray and Rodway 1931). The four species of trees were browsed clear to a height of 120 cm and the goats had started to eat bark from *Pisonia grandis*. Only two "miserable specimens" of *Tournefortia argentea* were

Notes to Table 3-1: 1 - not on the incomplete 1966 list but possibly present; 2 - seeds of *Caesalpinia bonduc* but no plants; 3 - inferred to be still present by Cribb but not seen by Belmont & Lentfer with the exception of an unidentified Asteraceae (possibly *Conyza bonariensis*); 4 - species not identified with certainty; 5 - seen by Belmont & Lentfer but not by Cribb; 6 - species uncertain, variously referred to *B. albifrons*, *B. diffusa* and *B. tetrandra*; 7 - seen by Cribb but not by Belmont & Lentfer; 8 - not seen by Belmont & Lentfer but noted as *Panicum* sp. by Cribb; 9 - not recorded by Chaloupka and Domm but almost certainly present.

Table 3-1. Vascular plant species recorded at Lady Musgrave Island in different years.

	1927	66	69	75	82	84	89	Status in 1989
NATIVE SPECIES								
Casuarina equisetifolia	+	+	+	+	+	+	+	common, south-western margin
Ficus opposita	+	+	+	+	+	+	+	common, throughout cay centre
Pandanus tectorius	+	+	+	+	+	+	+	common, north and east strand
Pisonia grandis	+	+	+	+	+	+	+	dominant forest over cay
Portulaca oleracea	+	-[1]	+	+	+	+	+	widespread, not abundant
Caesalpinia bonduc	-[2]	+	+	+	+	+	+	large thickets, south-eastern side
Tournefortiaia argentea	+	+		+	+	+	+	common, north and east strand
Hydrocotyle acutiloba	+	-[1]	+	+				
Abutilon asiaticum		+	+	+	+	+	+	common in forest clearings
Achyranthes aspera		-[1]	+	+	+	+	+	widespread, not abundant
Canavalia rosea		+	+	+	+	+	+	common, south half periphery
Ipomea pes-caprae		+	+	+[3]	+	+	+	common, south-eastern herb fields
Lepturus repens		+	+	+	+	+	+	co-dominant ground cover
Sesuvium portulacastrum		+	+	+	+	+	+	pond meadow, rare elsewhere
Solanum americanum		+	+	+	+[4]	+	+	widespread, not abundant
Sporobolus virginicus		+	+	+	+	+	+	uncommon, south-eastern clearings
Tetragonia tetragonioides		+	+	+	+	+	+	rare, south-eastern strand only
Thuarea involuta		+	+	+	+	+	+	co-dominant ground cover
Tribulus cistoides		+	+	+	+	+	+	widespread, not abundant
Boerhavia repens[6]		+		+[7]	+	+	+	uncommon
Malvastrum coromandelianum		+			+	+	+	dense patch in south-east clearing
Ophioglossum vulgatum		-[1]	+	?[3]				
Ruppia maritima		-[1]	+	?[3]				
Oxalis perennans		+						
Ipomea macrantha				+[5]	+[4]	+	+	uncommon, mainly ground cover
Euphorbia tannensis				+[7]	+	+	+	widespread, not abundant
Spinifex sericeus					+	+	+	rare
Ipomea sp.							+	one patch on herbs, camp area
NATURALISED ALIEN SPECIES								
Oxalis corniculata	+	-[1]	+	+	+	+	+	rare
Coronopus integrifolius	+					+	+[4]	rare
Coronopus didymus	+	-[1]	+	+[3]	+			
Cyperus rotundus	+							
Amaranthus viridis		-[1]	+	+	+	+	+	widespread, not abundant
Bidens pilosa		+	+	+	+	+	+	patchy abundance, southern half
Cakile edentula		+	+	+	+	+	+	common, north and eastern strand
Cenchrus echinatus		+	+	+	+	+	+	common but patchy
Sonchus oleraceus		+	+	+	+	+	+	uncommon, patchy, south half of cay
Conyza bonariensis		+	+	+[3]	?[4]	+	+	few, south-eastern clearings
Cynodon dactylon		+	+	+[3]	+	+	+	uncommon, patchy
Eleusine indica		+	+	+[3]	+	+	+	uncommon, patchy
Euphorbia prostrata		+	+	+[3]	+	+	+	rare
Argemone ochroleuca		+		+	+	+		
Digitaria ciliaris		+			+			
Eragrostis minor		+						
Panicum maximum				+[8]	+	+	+	one patch, northern strand
Trachymene cussonii					+	+	+	few, northern strand
Ipomea indica					+	+[9]	+	large patch near light tower
Conyza sumatrensis					?[4]		+	few
Lepidium bonariense					+			
Lepidium virginicum						+	+	rare, in clearings
Raphanus raphanistrum							+	rare
CULTIVATED SPECIES								
Lycopersicon esculentum		-[1]	+	+	+	?	+	small vines, camping area
Cucurbita pepo		-[1]	+	+[3]	+[4]	?	+	six vines, camping area
Carica papaya			+	?[3]				
Allium cepa				+[7]				
Solanum tuberosum				+[7]				
Cocos nucifera							+	seedling

Table 3-2. Non-cultivated plant species at Lady Musgrave Island in different years.

	1927	1969	1975	1982	1984	1989	All Years
Total species number	11	31	35	40	39	41	51
Native species number	7	20	22	23	23	24	28
Alien species number	4	11	13	17	16	17	23
Alien species %	36	35	37	42	41	42	45
Sea-dispersed species	3	14	15	17	17	17	17
Sea-dispersed species %	27	45	43	43	44	41	33

alive and MacGillivray and Rodway (1931) observed that the "animals seem now to be dependent upon the dead leaves that fall from the trees and the seaweed on the beach". There was competition between goats and nest-building Black Noddies for every leaf that fell to the ground (MacGillivray and Rodway 1931, Nebe 1932). Nebe (1928) described the *Pisonia* trees as stunted whereas Napier (1928) referred to 40 foot (12 m) high trees. MacGillivray and Rodway (1931) reported that most of the centre of the cay was occupied by *Ficus opposita* from 15 to 20 feet (4.5-6 m) high and abundance of this species was previously inferred in the 1890s by Ellis (1936) who noted flocks of doves feeding on the "wild figs".

Four years after the 1927 survey the goats had been greatly reduced by hunting and "much undergrowth, mostly *Abutilon* and coarse grasses" was present (Nebe 1932). Five years later the cay was "thickly wooded and the tangled undergrowth made direct levelling or cross-traverses impossible" (Steers 1938). A small holiday resort was built and operated at the southern side of the cay during the 1930's and the last remnants and debris were removed in 1984. The extent of island habitat modification and garden importation associated with the resort is unknown but no cultivated vegetables or ornamentals survived at the time of the next floristic surveys with the possible but unlikely exceptions of *Lycopersicon, Carica* or *Cucurbita.*

Over the following forty years the goat herd fluctuated in size from hunting (surviving at least one eradication attempt in 1948) until they were eliminated in 1971 with the exception a single animal that escaped until 1974 (P. Ogilvie, pers. comm.). H. S. Curtis sketched a vegetation map in October 1965 and made an incomplete species collection in November 1966 (Queensland Forestry Department files). Floristic surveys undertaken in July 1967 and in April 1969 were combined into a vegetation list by A. B. Cribb (letter to the Forestry Department). The lists of Curtis and Cribb are shown under "1966" and "1969" respectively in Table 3-1and demonstrate a large increase in native and alien plant species since the grazing-impoverished list of 1927.

In August-September 1975 twenty-eight plant species were recorded by Belmont and Lentfer (Heatwole 1984). Cribb also visited in July 1975 and listed seven new species in addition to species reported in 1969 (letter to the Forestry Department). Cribb noted that goat damage to *Casuarina* and *Pandanus* was repairing and that "removal of goats has led to a marked increase in ground cover of plants. Bare shingle ridges of conglomerate exposed by phosphate mining had been fairly conspicuous features of the cay during the 1969 visit but are now mostly obscured by ground cover plants." Three new species established at the cay in the early 1970s. Four more new species were present in January 1982 when Elsol (1986) mapped the vegetation and analysed distribution patterns.

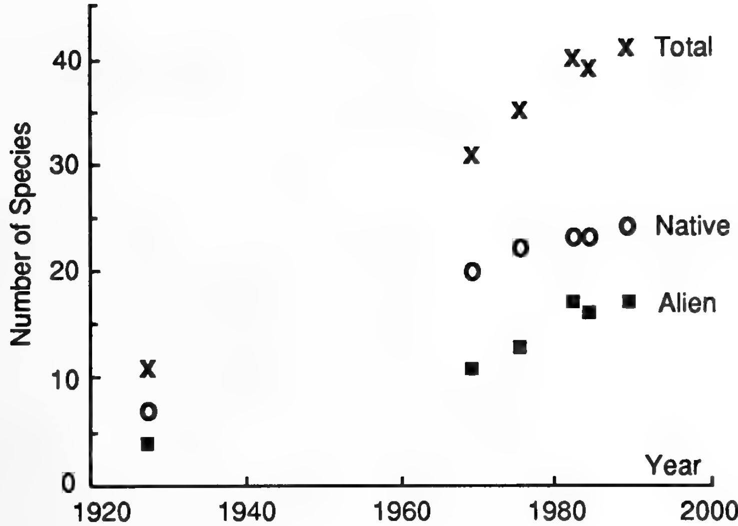

Fig. 3-2. Increase in species diversity at Lady Musgrave Island from 1927 to 1989. Strong linear correlations between species diversity and time (r = 0.996 total, 0.993 native, 0.975 alien) are misleading. Between surveys in 1927 and 1965 the plant density fluctuated with changing hunting intensity on the goats and diversity would also have fluctuated widely.

The 1982 floristic survey marks a turning point for the island vegetation. The last effects of destructive or selective grazing by goats had finally disappeared and subsequent floristic surveys in 1984 (Chaloupka and Domm 1986) and 1989(Tables 3-1, 3-2)indicate that species diversity has stabilised. Neglecting the introduced food plants, four species disappeared between 1982 and 1989 and five new species appeared. The changes may be less if, as seems likely, there was confusion with identification or collection of the two species each of *Coronopus*, *Conyza* or *Lepidium* reported. *Ipomea indica* was almost certainly overlooked or dormant in the 1984 survey as it dominated the same site in 1982 and in 1989.

The vegetation is presently experiencing strong competition for space. Establishment of new species has become difficult and some established species are being displaced by expansion of others. Dense ground cover of *Thuarea, Lepturus* and other species inhibit establishment of *Casuarina* seedlings and the population is decreasing slowly as the old trees die (but seedlings have been planted in recent years by park staff). *Pisonia* stands have expanded vegetatively shading out all other species to cover an area in 1989 more than twice that covered in 1967(Fig.3-1). Displacement of previously dominant *Ficus opposita* has been accompanied by extinction of the frugiverous Bar-shouldered Dove *Geopelia humeralis* population since 1927. *Pisonia* forest permits no undergrowth and in the absence of destructive cyclones or other events will form the climax vegetation. *Pisonia* was presumably present at the time of phosphate mining although the description of Jukes (1847) indicates that *Pisonia* cover was not significant in 1842. Impenetrable thickets of *Caesalpinia bonduc* are presently expanding and displacing other species (Elsol 1982). In 1989 several *Pisonia* and *Pandanus* trees were severely overgrown by this woody vine which could pose a challenge to the dominance of *Pisonia. Ipomea indica* also blanketed a large area of ground vegetation and trees near the navigation light in June 1989. This vine spread rapidly from a small area in January as a result of unusually high rainfall throughout the first half of the year.

PLANT DISPERSAL AND COLONISATION

The method of a species' arrival at a cay can be partially inferred from diaspore adaptations for anemochory, hydrochory, epizoochory or endozoochory and from previous knowledge of dispersal events. Arrival mechanisms are unclear when species have more than one natural dispersal mode or when there has been introduction of garden soil, building materials or other materials likely to contain diaspores. Building materials were imported to Lady Musgrave Island for a shelter hut in

about 1930, for resort buildings in the late 1930s, for an automatic navigation light tower in 1974 and for camper toilets in 1987. Food plants including tomato, pumpkin, pawpaw, onion and coconut have been taken to Lady Musgrave Island by visitors from time to time. These were intentionally planted or have propagated from discarded seeds and are not considered in the following examination of plant colonisation.

About 15% of species recorded at Lady Musgrave Island have diaspores that are dispersed by wind but with one exception this is primarily a short-distance mechanism. Offshore winds are weak, infrequent and not often likely to transport seeds of grasses, weeds or *Casuarina* across 60 km of sea from the mainland. One exception is *Ophioglossum vulgatum* (presumably the same species reported as *O. lusitanicum* on adjacent Fairfax Island by Cribb 1986) which has the tiny fern spores capable of extended aerial buoyancy. The grasses and weeds with wind dispersal capability have alternative dispersal modes by birds or people which are the more probable routes of arrival at Lady Musgrave Island. *Casuarina equisetifolia* is assumed to have colonised by sea dispersal. Plants with diaspores dispersed by the sea make up 33% of the total species list and 54% of the native species(Table 3-2).There are two sea-dispersed alien species, *Trachymene cussonii* and *Cakile edentula.*

About 65% of all species appear to have dispersed to Lady Musgrave Island via birds or people. The corresponding proportions of native and alien zoochorous species are 43% and 91% respectively. It is often difficult to differentiate between dispersal of small seeds carried internally by birds and those carried externally by birds or by people. One can speculate that the bulk of the alien species were accidentally carried to the cay by campers and tourists but there is little direct evidence to support this. Weeds initially introduced to Australia by human agency have subsequently spread by natural means.

Chaloupka and Domm (1986) have argued that anthropochory is the primary determinant of colonisation of southern Great Barrier Reef cays by alien plants. Using data from the Capricorn-Bunker Islands they reported that the percentage of alien species on each cay was strongly correlated with the amount of human visitation. This correlation was attributed to inadvertent dispersal of diaspores attached to the clothing and footwear of the visitors (anthropochory). The conclusions of Chaloupka and Domm (1986) have been reviewed by Heatwole and Walker (1989) who showed that while anthropochory may be an important process, other factors including introduction of gardens and soil, habitat modification by human activities and avian zoochory could equally well account for the observed patterns of alien plants on the Capricorn-Bunker Islands.

The eight-fold increase in tourist visitation at Lady Musgrave Island between the 1984 and 1989 floristic surveys makes it an ideal location to observe the effects of anthropochory. Annual numbers of campers at Lady Musgrave Island increased from 212 in 1984 to 992 in 1985 and 1,475 in 1988 (Department of Environment and Heritage permit records). Prior to 1985 the island was closed to campers for six months each year but from 1985 camping was permitted year-round. Accessibility of the cay was greatly boosted in July 1985 by commencement of a large tourist catamaran service from the mainland. The vessel and its associated seaplane carried more than 11,000 day-visitors in 1988. In addition to this the mean numbers of cruising yachts and motor boats present at the reef increased from 2.1 and 2.3 respectively in 1984 to 3.8 and 3.8 respectively in 1988 (data from twice-weekly aerial surveillance flights by the Department of Environment and Heritage). Simple estimates from the camper, tourist and vessel records (assuming an average of two people go ashore from each private vessel which remains at the reef for an average of two days)

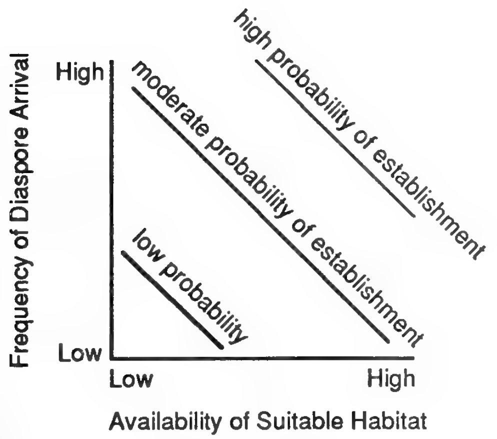

Fig. 3-3. The relationship between arrival and survival of a new plant species.

indicate that numbers of people visiting the cay increased from about 1,800 in 1984 to about 15,000 in 1988 (the most heavily visited cay on the Great Barrier Reef is Green Island which received about 240,000 tourists in 1988). The number of visitors in the four years from 1985 to 1988 is probably greater than the total number of visitors to Lady Musgrave Island during the preceding thirty year period.

Floristic differences between 1984 and 1989 involve only four species and are not consistent with a flora primarily influenced by anthropochory. *Argemone ochroleuca* disappeared (probably a seed-bank temporal) while *Raphanus raphanistrum*, *Conyza sumatrensis* and a new species of *Ipomea* appeared (the *Ipomea* resembles *I. indica* but is glabrous and may be an undescribed taxon). *Conyza sumatrensis* could have been present in 1984 but overlooked amongst the *Conyza bonariensis* (*Raphanus raphanistrum* was rare and might also have been overlooked previously). The floristic changes at Lady Musgrave Island from 1927 to 1989 indicate that habitat disturbance is more important to establishment of native or alien plants than anthropochory. This is a long-term evaluation because the relative importance of diaspore arrival undoubtedly fluctuates with respect to diaspore survival. There may at times be a surplus of immigrant diaspores but no suitable available habitat, or an excess of available habitat with an absence of immigrant diaspores. The situation most likely to occur is between these extremes with the probability of species establishment being directly dependent on the product of diaspore arrival frequency and habitat availability (Fig.3-3).

CONCLUSION

The floristic composition of Lady Musgrave Island is typical of the Capricorn-Bunker islands. The only species not recorded from the other islands of the group is the unidentified newly arrived *Ipomea* species. *Scaevola sericea* and *Wollastonia biflora* are notably absent from Lady Musgrave Island and from adjacent East Fairfax Island which was also defoliated by goat herds until recent years (Cribb 1986). These two sea-dispersed species may have difficulty colonising the strand which is excavated by nesting turtles during summer. Only 55% of species recorded at the island are native to Australia. The large increase in numbers of visitors to the cay between 1984 and 1989 has not been accompanied by significant change in the botanical species composition. If these visitors are transporting numerous diaspores to the cay then there can be little suitable habitat available for colonisation and trampling effects must be insignificant in creating such habitat.

Human interference with the vegetation has been severe particularly with respect to phosphate mining and release of goats but these effects should not obscure the fact that the flora of Lady Musgrave Island has progressed from scrubby vegetation less than a metre high in 1843 to a predominant cover of mature *Pisonia grandis* forest. Mining and grazing retarded this progression but, as with some other Capricorn-Bunker cays, the vegetation was notably less advanced last century prior to known European impact. Whether this is indicative of the youth of the cays or of a history interrupted by cyclonic destruction is unknown. The abundance of phosphate cay rock could be interpreted as evidence of a previous *Pisonia* forest (Fosberg 1957) but such rock might also form in the absence of *Pisonia* (Part I).

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Plate 1. *Pisonia grandis* with large double trunk (Cairncross Island, October 1988).

Plate 2. Shallow *Pisonia* root system uncovered by *Megapodius reinwardt* digging at Bushy Island (August 1989).

Plate 3. Soil profile in *Pisonia* forest at Heron Island (August 1988). Less than a metre of sand with *Pisonia* humus and roots overlying white coral sand.

Plate 4. Coppice shooting from a fallen *Pisonia* branch (Heron Island, August 1988).

Plate 5. *Pisonia* forest at Lady Musgrave Island (September 1986 photo from light tower).

Plate 6. Deciduous *Pisonia* forest (Douglas Island, October 1988).

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FLORE ET VEGETATION DE L'ILE DE WALPOLE

BY

ALAIN RENEVIER AND JEAN-FRANCOIS CHERRIER

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FLORE ET VEGETATION DE L'ILE DE WALPOLE

BY

ALAIN RENEVIER[1] AND JEAN-FRANCOIS CHERRIER[2] †

ABSTRACT : WALPOLE Island (168° 58'E - 23 ° 38'S), southernmost and most isolated of the Loyalty group, is described in detail. Plant and animal species known to occur are listed, largely as a result of recent field work by the authors. Plant associations are mapped.

I - INTRODUCTION

L'île de WALPOLE est une des Dépendances du Territoire Français d'Outre-Mer de la NOUVELLE-CALEDONIE. Elle est située à 180 km à l'Est du Canal de la HAVANNAH ; longitude 168°58' Est, latitude 22°38' Sud. Elle appartient à l'arc des Loyauté. Elle fût découverte le 17 novembre 1794 par le Capitaine Anglais BUTLER qui lui donna le nom de son navire.

II - GEOLOGIE ET TOPOGRAPHIE

L'île a une origine volcanique. Au cours des glaciations des 400.000 dernières années, l'île s'est trouvée émergée et immergée à plusieurs reprises et s'est recouverte d'une calotte corallienne. Celle-ci subit des effets de l'érosion et le calcaire se détache par blocs, parfois énormes, quand il n'est pas dissout par les eaux de pluies.

Donc, l'île de WALPOLE se présente comme un plateau corallien relativement horizontal, mais terriblement "mal pavé" d'énormes blocs de corail déchiqueté.

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1. Ecole Publique de la Foa. Nouvelle Calédonie
2. Centre Technique Forestier Tropical (CTFT). BP 41 - Nouméa - Nouvelle Calédonie

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† "Jean-François Cherrier, Ingenieur des Eaux et Forêts et Directeur du Centre Technique Forestier Tropical en Nouvelle Calédonie, est décédé le 26 juillet 1991 lors d'un accident d'avion dans le nord de l'île de Santo. Apprecié de loin, c'était un naturaliste de terrain passioné de forêts, de plongées et de spéléologie."

Les "trous" entre les blocs étaient remplis de guano et leur exploitation a laissé un terrain où la marche est difficile et parfois dangereuse ; l'île est orientée Nord-Sud, longue d'environ 4 km, et large de 400 à 1.000 m. La largeur est maximale au Nord et minimale au Sud (au niveau des anciennes installations d'exploitation du guano). Elle est bordée de hautes falaises verticales (70 à 80 m) tombant directement dans la mer, sauf :

- sur la Côte Est où les falaises tombent sur une petite plaine côtière ;

- au Nord-Ouest et au Sud-Ouest se trouvent deux petits platiers recouverts de blocs d'éboulis.

Le seul mouillage sûr est à l'Ouest, et le débarquement se fait au Sud-Ouest (que par beau temps) où se situent les restes des installations de l'ancienne exploitation de guano.

L'accès au plateau est possible au Sud-Ouest où un chemin a été aménagé du temps de l'exploitation du guano : chemin en zig-zag complété par des marches en briques (très dégradées aujourd'hui, mais encore très praticables).

Les falaises sont constellées de milliers de trous (dûs à l'érosion pluviale). Les oiseaux de mer y nichent (surtout les phaetons).

III - SOLS

Il n'y a pas de sols réellement bien développés sur l'île :

a - Sur le plateau, une litière très épaisse faite de feuilles, (surtout de Pandanus) recouvre le calcaire et les poches de guano.

b- Sur le platier Est, à la base de la falaise, la litière couvre un début de rendzine, mais sur une bande très étroite.

Il s'agit donc de sols très jeunes et très peu développés pouvant évoluer vers des sols bruns calciques.

IV - RESEAU HYDROGRAPHIQUE

Il n'y a pas de rivière. L'eau des pluies s'infiltre dans le calcaire corallien et creuse des cavités. Ces dernières, quand elles sont accessibles, montrent des traces d'activités érosives (concrétions diverses), mais rares sont celles qui renferment de l'eau douce (en très petite quantité).

L'île est donc sans eau apparente.

Il n'y a aucune grotte qui pénètre la roche.

V - CLIMAT

Il n'y aucun relevé météorologique sur l'île de WALPOLE. Cependant, les conditions relevées sur les deux îles les plus proches : MARE au Nord (à 135 km) et l'ILE-des-PINS à l'Ouest (à 150 km) devraient nous donner une assez bonne idée des températures et des précipitations de WALPOLE, ces trois îles étant très semblables par leur substrat, leur relief et leur position géographique.

Le climat est de type subtropical, tempéré par l'influence de l'océan et des alizés du Sud-Est.

CRITERES / ILES	MARE (1971-1986)	ILES DES PINS (1972-1986)
Températures moyennes annuelles.................	22,3° C	22,4° C
Amplitude thermique quotidienne..............	20,0° C	12,5° C
Température minimum absolu	2,8° C	10,0° C
Température maxima absolu	35,0° C	33,4° C
Altitude de l'île..........	138 m	262 m
Pluies annuelles.........	1.531 mm	1.307 mm
Nombre de jours de pluies	124	120
Humidité relative........	80 %	80 %
Evaporation annuelle...	749 mm	1.346 mm

Les températures journalières peuvent donc présenter des écarts de 15 à 20°C, et des extrêmes importants : l'île de MARE est plus froide.

Les alizés du Sud-Est soufflent en permanence, et rendent la côte Est inabordable. Les extrémités Nord et Sud sont les sièges de forts courants marins.

VI - PEUPLEMENT HUMAIN

L'île de WALPOLE est inhabitée en temps normal.

Cependant, des traces de vies passées existent :

a - Des ossements humains et des outils primitifs, d'anciennes traces de feux, découverts dans les cavernes, indiquent que l'île a été habitée. Cependant, les conditions rudes de vie : problème d'approvisionnement en eau, en nourriture, relief très rude, mer souvent houleuse ne devaient permettre qu'un sursis de vie à des naufragés, plutôt qu'un peuplement volontaire et de longue durée.

b - De 1910 à 1936, une exploitation du guano a permis d'extraire et d'exporter sur la NOUVELLE ZELANDE quelques 150.000 tonnes. Plusieurs centaines de personnes ont vécu et travaillé sur l'île. Leur histoire est bien connue et confirme les grandesdifficultés à survivre sur WALPOLE.

VII - VEGETATION

Plusieurs missions scientifiques ont permis de récolter des échantillons botaniques : en particulier en novembre 1972 (Gilbert SAM et Henri HMAKONE), en décembre 1977 (J.M. VEILLON et P. BENOIT). Mais elles étaient de courtes durées (quelques heures) ; c'était toujours les mêmes zones qui étaient visitées (la pointe Sud-Ouest).

En novembre 1987, Jean-François CHERRIER a pu, en 4 jours, prospecter toute l'île, le platier Est et les falaises rocheuses.

En août 1988, Alain RENEVIER Jean-François CHERRIER, en 5 jours, ont prospecté le platier Nord-Ouest et le plateau Nord. Ceci a permis une meilleure connaissance de la forme, mais surtout de la flore et de la faune de l'île.

A - Formations végétales (carte 2) :

Une coupe Ouest-Est permet de rencontrer à partir de la mer, la succession suivante des associations végétales :

a - Une zone nue balayée sans cesse par les vagues (photo 1) ;

b - Une zone de 5 à 10 mètres de large où, à même la roche nue, pousse Pemphis acidula, avec parfois Wedelia uniflora et Bikkia tetrandra, c'est-à-dire une végétation rabougrie et saxicole. Cette zone n'existe qu'au Nord-Ouest, au Sud-Ouest et sur la côte Est (photos 1 - 2 -7) ;

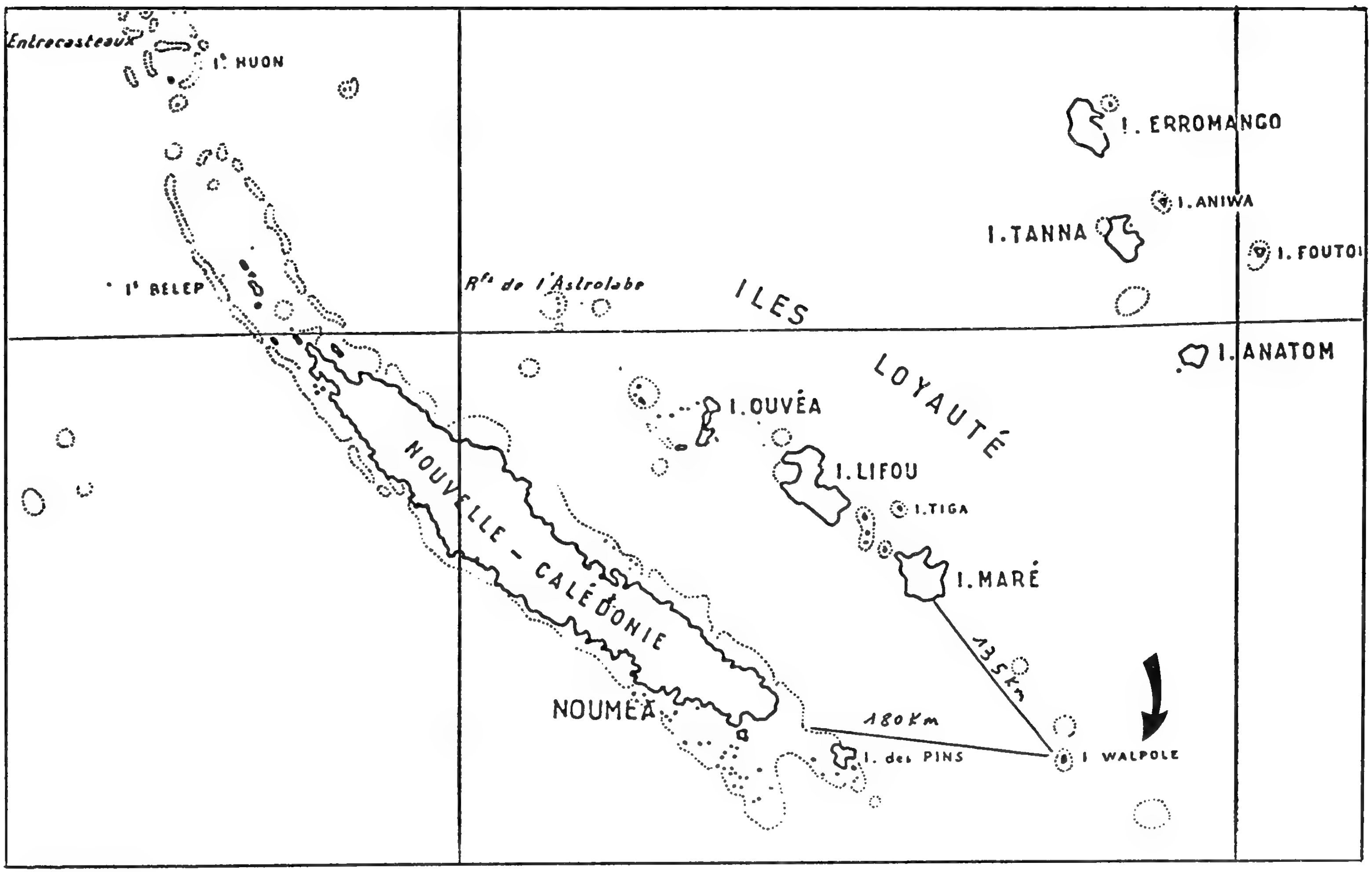

Entrecasteaux
Iˢ HUON
Iˢ BELEP
Rᶠˢ de l'Astrolabe
ILES LOYAUTÉ
I. ERROMANGO
I. ANIWA
I. TANNA
I. FOUTOI
I. ANATOM
I. OUVÉA
I. LIFOU
I. TIGA
I. MARÉ
NOUVELLE - CALÉDONIE
NOUMEA
135 Km
180 Km
I. des PINS
I WALPOLE

Figure 1

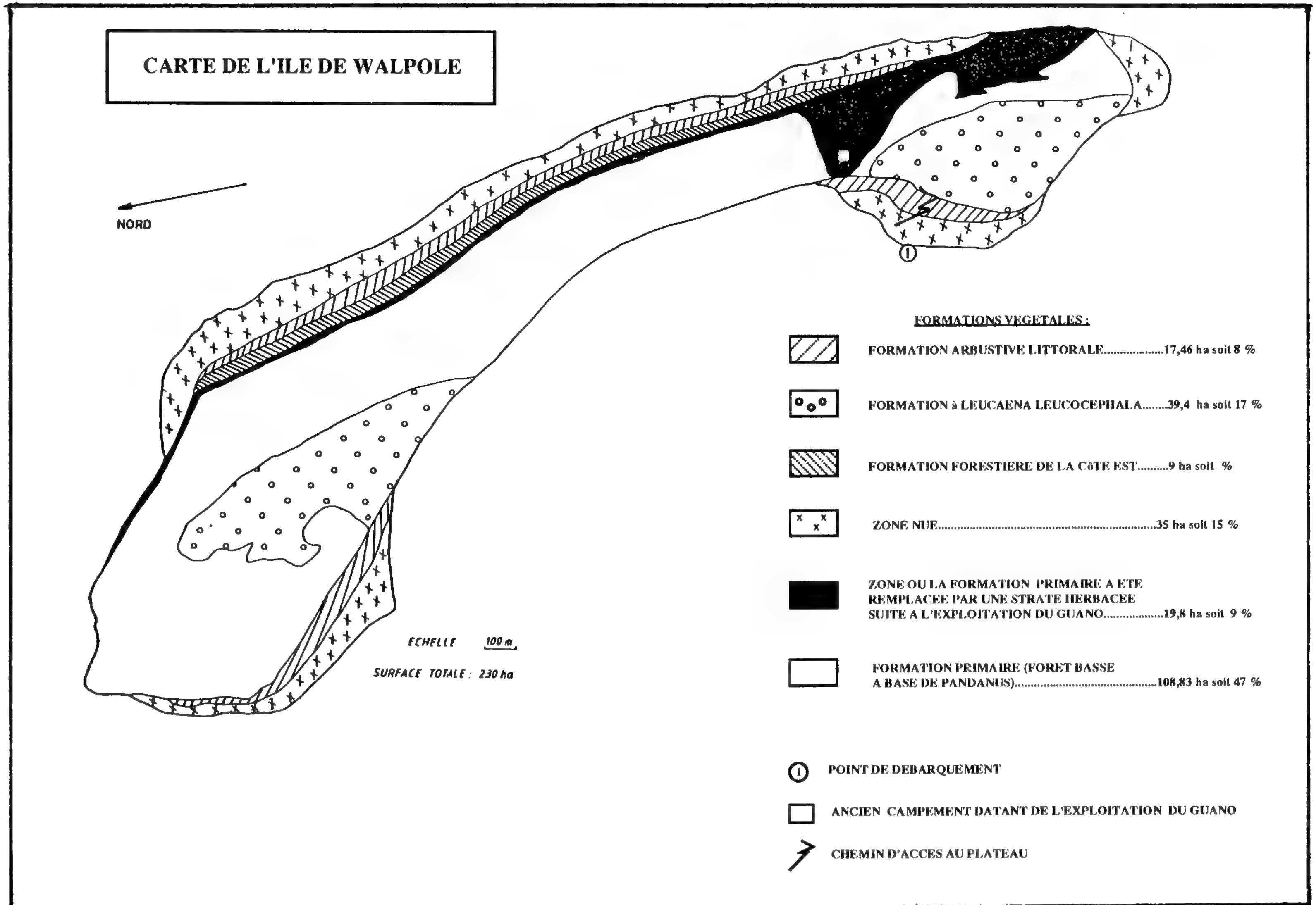
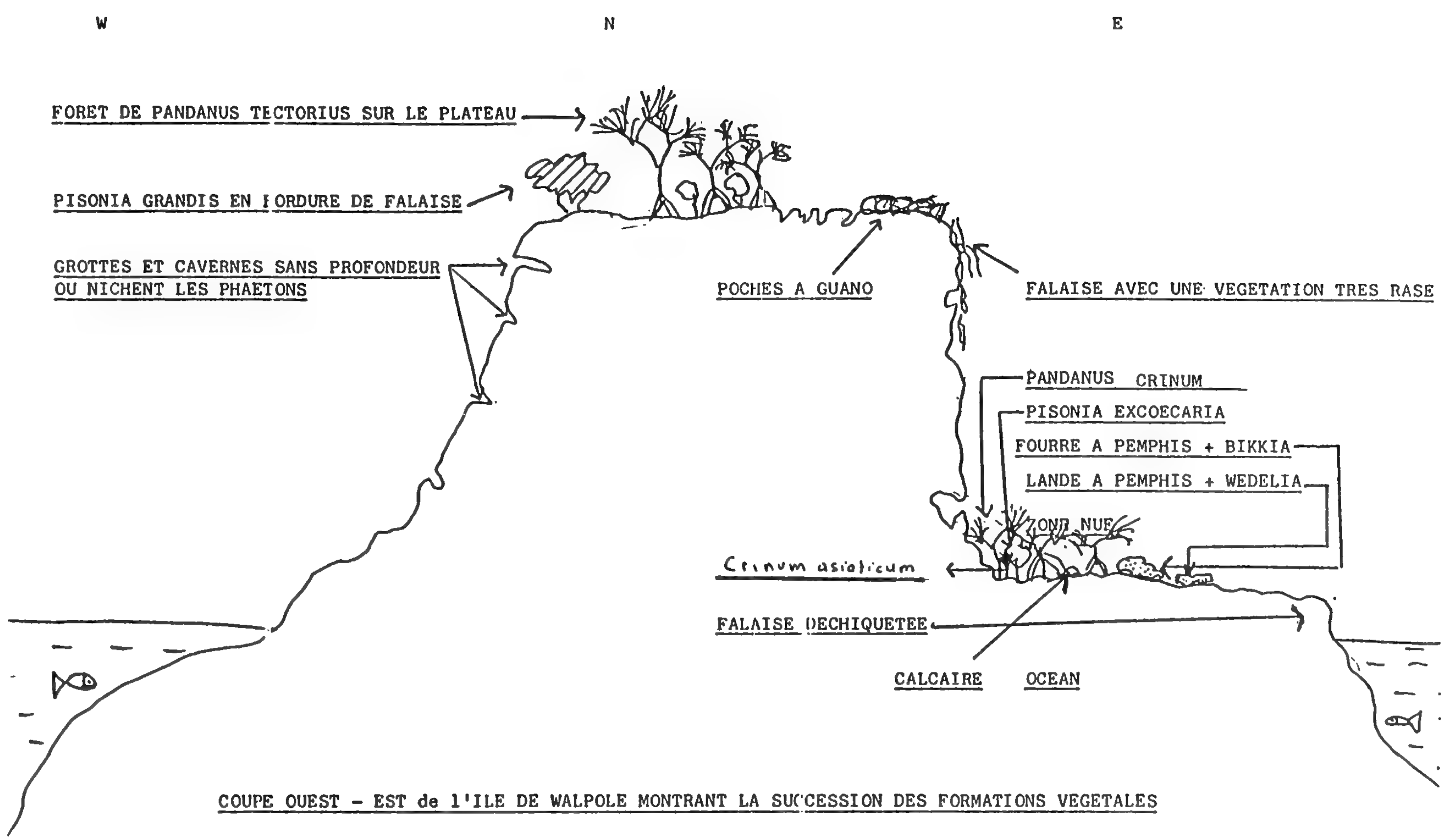

CARTE DE L'ILE DE WALPOLE
NORD
ECHELLE 100 m
SURFACE TOTALE : 230 ha
①
FORMATIONS VEGETALES :
FORMATION ARBUSTIVE LITTORALE..................17,46 ha soit 8 %
FORMATION à LEUCAENA LEUCOCEPHALA........39,4 ha soit 17 %
FORMATION FORESTIERE DE LA CôTE EST..........9 ha soit %
ZONE NUE..35 ha soit 15 %
ZONE OU LA FORMATION PRIMAIRE A ETE REMPLACEE PAR UNE STRATE HERBACEE SUITE A L'EXPLOITATION DU GUANO..................19,8 ha soit 9 %
FORMATION PRIMAIRE (FORET BASSE A BASE DE PANDANUS)..108,83 ha soit 47 %
① POINT DE DEBARQUEMENT
ANCIEN CAMPEMENT DATANT DE L'EXPLOITATION DU GUANO
CHEMIN D'ACCES AU PLATEAU

Figure 2



COUPE OUEST - EST de l'ILE DE WALPOLE MONTRANT LA SUCCESSION DES FORMATIONS VEGETALES

Figure 3

c - La falaise commence sans transition et porte, où les plantes peuvent s'accrocher, quelques individus (photo 3) de :

- Pisonia grandis - arbre ;
- Ficus obliqua - arbre ; (photos 3 et 8)
- Wedelia uniflora - herbe ;
- Euphorbia pancheri - herbe ;

d - Le plateau où se distinguent plusieurs associations végétales.

i) La formation à Pandanus tectorius qui occupe l'essentiel du terrain. C'est l'association principale.

Avec le Pandanus se développent :

- Ochrosia elliptica - arbuste ;
- Cassia gaudichaudii - arbuste ;
- Croton insularis - arbuste ;
- Hemicyclia deplanchei - arbuste ;
- Ficus spp. - arbuste ;
- Eugenia sp. - arbuste ;
- Pisonia grandis - surtout en bordure de falaise
- Guettarda speciosa - arbuste
- Microsorium punctatum - fougère
- Phymatosorus grossus - fougère (photos 12 et 5)

ii) Les anciennes zones d'occupation humaine et plusieurs zones dans le centre du plateau sont occupées par :

- Leucaena leucocephala - arbuste
- Passiflora suberosa - liane
- Solanum nigrum - herbe
- et diverses herbacées introduites (photo 4).

iii) Les anciennes zones d'exploitation du guano et le bord Est du plateau (très venté) portent une formation rase, souvent herbacée, où dominent :

- Wedelia uniflora - grande herbe ;
- Pipturus argenteus - arbuste ;
- Euphorbia pancheri - arbrisseau ;
- Ficus spp. - arbuste ;
- Abutilon indicum - arbrisseau. (photo 6)
- Sida spp. - arbrisseau ;
- Jasminum didymum - liane ;
- Solanum nigrum - arbrisseau.

e - La falaise Est est identique à celle de l'Ouest, mais généralement plus fournie.

f - La zone côtière est présente de la base de la falaise vers la mer :

i) Un bande de Pandanus tectorius mélangés à des Crinum asiaticum et quelques Bikkia tetrandra (photo 10).

ii) Une bande forestière de 20 à 30m de large composée de :

- Pisonia grandis - arbre ;
- Excoecaria agallocha - arbre ;
- Cocos nucifera - à un seul endroit.

La hauteur varie de 8 à 10m (photos 7 et 9).

iii) Une bande arbustive de 10-20 m de large faite de :

- Pemphis acidula - arbuste ;
- Excoecaria agallocha - arbre ;
- Ficus obliqua - arbuste ;
- Bikkia tetrandra - arbuste (photos 7 et 11)

iv) Une zone d'environ 10m de large occupée presque uniquement par Pemphis acidula et quelques Euphorbia.

Puis la roche nue avant la mer (photo 7 et 9).

B - Commentaires :

- La "forêt de Pandanus" du plateau est remarquable par son existence et sa taille.

- L'île est relativement riche avec 98 espèces pour des conditions écologiques rudes. Il est vrai que les espèces introduites représentent 30 % environ des espèces .

Il n'y a pas d'exemplaires d'espèces littorales classiques comme :

- Le Tamanou (Calophyllum inophyllum - Guttifère) ;
- Le Bois de Rose (Thespesia populnea - Malvacée) ;
- Le Bois Bleu (Hernandia ovigera - Hernandiacée) ;
- Le Martaoui (Acacia simple - Légumineuse) ;
- Le Bonnet d'Evêque (Barringtonia asiatica - Barringtoniacée) ;
- Le Bois de Fer (Casuarina equisetifolia - Casuarinacée)

lesquels recherchent surtout les zones sableuses.

Cependant, il n'y a pas non plus de :

- Kohu (Intsia bijuga - Légumineuse) ;
- Buni (Malilkara dissecta var. pancheri - Sapotacée) ;

- Pin colonnaire (Araucaria columnaris - Araucariacée), sauf un individu, sans doute planté, de 5-6m de haut à mi-pente, en bordure de chemin d'accès au plateau alors que ceux-ci se développent sur les falaises calcaires de l'ILE-des-PINS et des Iles LOYAUTE (mais les conditions écologiques de l'Ile de WALPOLE sont peut-être trop dures pour ces espèces) ;

- Aucune espèce de la famille des orchidées ;

- Beaucoup de Pisonia grandis, Wedelia uniflora, Bikkia tetrandra ;

- La bande de Crinum asiaticum (entre les Pandanus et les Pisonia) à la base de la falaise Est est remarquable ;

- Aucun Leucaeana insularum n'a été vu ;

- Quelques plantes dont la présence est intéressante comme :

- Cassia gaudichaudii ;
- Einadia polygonoïdes ;
- Evolvulus alsioïdes var. philippinensis ;
- Delarbrea paradoxa ;
- Eugenia cf. noumeensis ;
- Ficus lifouensis ;
- Kochia hirsuta ;
- Mucuna gigantea ;
- Neisosperma oppositifolia ;
- Psychotria nummularioides.

Pour la première fois, les zones Nord et Est ont pu être prospectées, ce qui permet d'avoir aujourd'hui, une bonne connaissance de la botanique de l'île.

ZOOLOGIE :

Cette île, malgré sa taille, accueille de très nombreux animaux. Les oiseaux marins dominent nettement. La période de reproduction se poursuit toute l'année, avec un maximum en fin d'année :

- Sterne blanche : Gygis alba candida - laridé ;
- Chevalier à pieds courts : Tringa brevipes - scolopacidé ;
- Noddis à cape blanche : Anous tenuirostris minutus - laridé ;
- Paille-en-queue : Phaëton rubricauda - Phaetonitidé ;
- Phaëton à queue blanche : Phaëton lepturus dorthae - Phaetonitidé ;
- Fou à pattes rouges : Sula sula rubripes - sulidé ;
- Fou à ventre blanc : Sula leucogaster plotus - sulidé ;
- Frégate : Fregata ariel ariel - frégatidé ;
- Pluvier doré : Pluvialis dominica fulva - charadriidé.

Ces animaux sont représentés par des milliers d'individus sur l'île.

Les fous et les frégates nichent surtout sur les Pisonia grandis et les Pemphis acidula. Les noddis préfèrent les Pandanus et les phaëtons, les trous dans les falaises calcaires. La végétation souffre nettement de la présence des oiseaux et des nombreux nids qu'elle doit supporter.

Ont été vus, en quelques individus, des alcyons, des riphidures et, en haute mer, des puffins et un albatros (communication personnelle de M. PHILIPPOT Marcel).

L'île porte pour tout : 2 reptiles, 1 petit lézard gris non identifié et 1 scinque.

De la présence humaine du temps de l'exploitation du guano, il ne reste plus aucun des mammifères lâchés sur l'île (qui servaient de nourriture fraîche disponible selon les besoins) mais, par contre, de très nombreux rats et cafards.

Enfin, la psylle (Heteropsylla cubana), originaire d'Amérique Centrale, qui a envahit tout le Pacifique, d'Est en Ouest, en 1985 et 1986, détruisait efficacement les Leucaena leucocephala du plateau.

Aucun serpent terrestre et marin, ni aucun rapace n'a été noté.

Les fonds sous-marins sont très riches en individus (coraux, poissons, algues...) mais assez pauvres en espèces. Les parois rocheuses tombent dans la mer, descendent en pente douce jusque vers 50m et ensuite disparaissent rapidement dans les grandes profondeurs.

Les poissons pêchés et/ou vus dans la zone WALPOLE sont les suivants :

- Thons à nageoires jaunes : Thunnus albacares - Scombridé ;
- Coryphène : Coryphaena hippurus - Coryphaenidé ;
- Thons dents de chiens : Gymnosarda unicolor - Scombridé ;
- Tazards du lagon : Scomberomorus commerson - Scombridé ;
- Saumon du Pacifique : seriole : Elagatis bipinnulata - Carangidé ;
- Mékoua : Aprion virescens - Etelidé ;
- Wahoo ou tazard du large : Acanthocybium solanderi - Scombridé ;
- Bonite du lagon : Euthynnus affinis - Scombridé.

Ces poissons se conservent mal :

- Caranges - Seriola dumerili et Caranx melampygus - Carangidés ;
- Bonite à ventre rayé : Katsuwonus pelamis - Scombridé ;
- Barracudas : Sphyraena barracuda - Sphyraenidé ;
- Des voiliers sont souvent vus : Istiophorus platypterus - Istiophoridé ;
- ainsi que des marlins bleus : Makaira mazara - Istiophoridé ;
- et des marlins rayés : Tetrapterus audax - Istiophoridé.

Les requins qui fréquentent ces régions sont facilement visibles :

- Requins tigres : Galeocerdo cuvier - Carcharhinidé ;
- Requins marteau : Sphyrna makarran - Sphyrnidé ;
- Requins à pointes noires : Carcharhinus melanopterus - Carcharhinidé ;

- Requins à pointes blanches : Carcharhinus longimanus - Carcharhinidé ;
- Requins gris : Carcharhinus amblyrhynchos - Carcharhinidé ;
- Requins mako : Isurus oxyrynchus - Lamnidae ou Isuridée ;
- Requins renard : Alopias vulpinus - Alopiidae

Parmi les 51 espèces d'ARTHROPODES récoltés nous notons :

CRUSTACES

- Isopodes (cloportes) :		1 sp non identifiée

MYRIAPODES

- Chilopodes (scolopendres)		1 sp non identifiée

ARACHNIDES

- Acariens Ixodidae (tiques)		1 sp non identifiée
- Araignées		8 sp non identifiées

INSECTES

- Blattoidea Blattidae (cafards)		1 sp Periplaneta cf. australasica 1 sp non identifiée (larve)
- Isoptères - termites (trouvée dans les troncs morts de Leucaena)		1 sp non identifiée
- Coléoptères	Anthribidae	1 sp non identifiée
	Cerambicidae	1 sp non identifiée
	Tenebrionidae	1 sp non identifiée
	Cucujidae	1 sp non identifiée
	Coccinellidae	4 sp (Olla vinigrum Coccinella repanda Coelophora mulsanti Henosepilachna sparsa 26 punctata)
	Nitidulidae	1 sp
- Hemiptères Miridae (punaises)		2 sp non identifiées
- Hyménoptères	Apoidea Halictidée (abeilles)	1 sp non identifiée
	Sphecoidea	1 sp non identifiée

	Formicoidea formicidae (fourmis)	1 sp non identifiée
- Diptères	Nématocères Sciaridae	1 sp non identifiée
	Nématocères Culicidae	1 sp non identifiée
	Brachycères (Orthorraphes) Asilidae	2 sp non identifiées
	Dolichopididae	1 sp non identifiée
	Brachycères (Cyclorraphes)	
	Muscidae Haplostomate	1 sp non identifiée 1 sp non identifiée
- Homoptères	Heteropsylla cubana	
- Lépidoptères	(Rhopaloceres Papillons de jour) 3 sp	
	Pieridea	1 sp Appias paulina ega (Boisduval) (se développe sur Drypetes deplanchei)
	Lycaenidae	1 sp Catochrysops panormus caledonica (Felder)
	Nymphalidae	1 sp Hypolimnas bolina (Linné) (se développe sur Pipturus argenteus)
	Lepidoptères (Héteroceres) (papillons de nuit) 13 sp	
	Noctuidae	1 sp Achaea janata 3 sp - -
	Pyralidae	1 sp Agriolypta excelsalis 1 sp Hymenia recurvalis 3 sp - -
	Geometridae	2 sp 2 sp famille et genre non identifiés

Puis deux espèces de Gastéropodes ont été récoltées :

- l'une sous des pierres ;
- l'autre sur des végétaux.

PLANTES RECOLTEES A L'ILE DE WALPOLE

Les spécimens cités sont, sauf indication contraire, récoltés par M. CHERRIER Jean-François et numérotés dans la série de M. MACKEE H.

Ils sont déposés à PARIS (MUSEUM NATIONAL D'HISTOIRE NATURELLE - PARIS) ; des doubles se trouvent en général à NOUMEA (Centre ORSTOM de NOUMEA) et parfois dans d'autres herbiers. Les mêmes espèces sont souvent représentées à PARIS et à NOUMEA par d'autres récoltes de cette île.

Les espèces citées sans spécimen furent déterminées sur place par M. CHERRIER J.F.. L'astérisque indique une espèce introduite à l'île.

PTERIDOPHYTA
ASPLENIACEAE

Asplenium australasicum (J.Sm.) Hook - (44082)

DAVALLIACEAE

Arthropteris neocaledonica Copel. (44037)
Nephrolepis hirsutula (Forst.) Presl (Veillon 3363)

POLYPODIACEAE

Microsorium punctatum (L.) Copel. (Benoit in MK 34406)
Phymatosorus grossus (Langsd. et Fisch.) Brownlie (Benoit in MK 34403)

PSILOTACEAE

Psilotum nudum (L.) P. Beauv. (Hmakone et Sam in MK 25855)

GYMNOSPERMAE
ARAUCARIACEAE

* Araucaria columnaris (Forst.) Hook.

MONOCOTYLEDONES
AMARYLLIDACEAE

Crinum asiaticum L.
* Hippeastrum puniceum (Lam.) Voss (Benoit in MK 34404)

CYPERACEAE

Cyperus stoloniferus Retz. (44034)
Fimbristylis cymosa R. Br. (44047)

GRAMINEAE

Bothriochloa sp. (44049)
* Cynodon dactylon (L.) Pers. (43799)
Digitaria sp. (43802 - 44045)
Eragrostis sp. (43805 - 44056)
Lepturus cf. repens R. Br. (43804)
* Panicum maximum Jacq. (44036)
Sporobolus virginicus (L.) Kunth (43817)
Stenotaphrum micranthum (Desv.) Hubb. ex Hubb. et Vaughan (43803)

PALMAE

* Cocos nucifera L.

PANDANACEAE

Pandanus tectorius Sol. ex Balf. (Benoit in MK 34398)

DICOTYLEDONES
AIZOACEAE

Sesuvium portulacastrum L. (43826)
Tetragonia tetragonioides (Pallas) O. Ktze (43815)

AMARANTHACEAE

Achryanthes aspera L. (Hmakone et Sam in MK 25850)

APOCYNACEAE

*Catharanthus roseus (L.) G. Don (44046)
Cerbera manghas L. (43830)
Neisosperma oppositifolia (Lam.) Fosb. et Sachet (44795)
Ochrosia elliptica Labill. (43797)

ARALIACEAE

Delarbrea paradoxa Vieill. (44086)

ASCLEPIADACEAE

Tylophora insulincola S. Moore (44041)

BIGNONIACEAE

*Tecoma stans (L.) Juss. ex HBK (44059)

BORAGINACEAE

Cordia subcordata Lam. (44048)

CAPPARACEAE

Capparis sp. (43818)
*Cleome gynandra L. (44043)

CHENOPODIACEAE

Einadia polygonoides (Murr) P.G. Wilson (43788-44071)
Kochia hirsuta Nolte (43783)

COMPOSITAE

*Emilia sonchifolia (L.) DC. (Hmakone et Sam in MK 25849)
*Erigeron sp. (Hmakone et Sam in MK 25875)
*Parthenium hysterophorus L. (44070)
*Sonchus oleraceus L. (44083)
*Tridax procumbens L. (44063)
Wedelia uniflora (Forst.) W. Oliv. (43821)

CONVOLVULACEAE

*Evolvus alsinoides (L.) L. var. philippinensis Oostr. (44064)
*Ipomoea hederifolia L. (44074)
Operculina ventricosa (Bertero) Peter (44069)

CRUCIFERAE

*Brassica chinensis L. (44044)
Lepidium sp. (43791-44078)

CUCURBITACEAE

*Momordica charantia L. (44040)

EUPHORBIACEAE

Croton insulare Baill. (43794)
Drypetes deplanchei (Brongn. et Gris) Merr. (43784)
Euphorbia pancheri Baill. (44055)
Excoecaria agallocha L. (43796)
*Phyllanthus amarus Schum. et Thonn. (44084)

GOODENIACEAE

Scaevola sericea Forst. (43823)

LABIATAE

Plectranthus parviflorus Hencke (Hmakone et Sam in MK 25878)

LEGUMINOSAE

Caesalpinia bonduc L. (43809)
Canavalia rosea (Sw.) DC. (44053)
Cassia gaudichaudii Hook. et Arn. (43837)
*Cassia sophera L. (44035)
*Desmanthus virgatus (L.) Willd. (44080)
*Leucaena leucocephala (Lam.) de Wit (Hmakone et Sam in MK 25853)
Mucuna gigantea (Willd.) DC. (44058)
Vigna marina (Burm.) Merr. (?) (Hmakone et Sam in MK 25886)

LYTHRACEAE

Pemphis acidula Forst. (Benoit in MK 34405)

MALVACEAE

Abutilon indicum (L.) Sweet (44072)
Hibiscus tiliaceus L. (43835)
Sida nummularia Bak. f. (44079)
*Sida rhombifolia L. (Veillon 3373)
*Malvastrum coromandelianum (L.) Garke (44076)

MORACEAE

Ficus lifouensis Corner (43985)
Ficus obliqua Forst. (43800)
Ficus scabra Forst. (43806)

MYRTACEAE

Eugenia cf. noumeensis Guillaum. (43812)

NYCTAGINACEAE

Boerhavia repens L. (43840)
Pisonia grandis R. Br. (43836)

OLEACEAE

Jasminum didymum Forst. (44057)

OXALIDACEAE

Oxalis corniculata L. (44052)

PAPAVERACEAE

*Argemone mexicana L. (44042)

PASSIFLORACEAE

*Passiflora suberosa L. (Benoit in MK 34397)

PIPERACEAE

Peperomia endlicheri Miq. (44051)

PLUMBAGINACEAE

Plumbago zeylanica L. (44062)

PORTULACACEAE

Portulaca cf. lutea Sol. ex Forst. (43790)
Portulaca sp. (43839)

RUBIACEAE

Bikkia tetrandra (L.f.) A. Richard (43827)
Guettarda speciosa L. (43833)
Morinda citrifolia L. (43798)
Psychotria nummularioides Guillaum. (43793)

RUTACEAE

Zieridium sp. (Veillon 3383)

SAPINDACEAE

Arytera chartacea Radlk. (44085)
Podonephelium homei (Seem.) Radlk. (44081)

SOLONACEAE

Nicotiana fragrans Hook. (43828)
*Nicotiana tabacum L. (44039)
*Solanum nigrum L. (44060)

STERCULIACEA

Melochia odorata L. (43829)

UMBELLIFERAE

Apium prostratum (Thouars) Labill. (43825)

URTICACEAE

Pipturus argenteus (Forst.) Wedd. (44061)

VERBENACEAE

*Stachytarpheta indica (L.) Vahl (Hmakone et Sam in MK 25843)

ZYGOPHYLLACEAE

Tribulus cistoides L. (43792)

CONCLUSION

Cette petite île, hors des routes maritimes, difficile d'accès, est originale et présente plusieurs pôles d'intérêts. Sa végétation renferme beaucoup d'espèces par rapport à sa taille (dont plusieurs assez rares).

Les animaux sont aussi très nombreux, mais il n'y a que très peu d'espèces dans les groupes supérieurs ; par contre, les insectes sont très représentés.

Les occupations humaines semblent remonter assez loin dans le temps, mais n'ont apparemment jamais duré. Les conditions de survie y sont rudes.

Par ses caractéristiques, l'île de WALPOLE est un exemple peu fréquent alors que la NOUVELLE-CALEDONIE, par ses Dépendances, possèdes des dizaines d'îles. Dans le Pacifique, nous pouvons citer les îles de MAKATEA (POLYNESIE FRANCAISE) et d'ATIU (Archipel des Iles COOK). Leur comparaison serait riche d'enseignement.

Leur aspect et leurs caractéristiques marines en font des îles difficiles d'accès et les interventions humaines sont rares. Ceci leur assurera une protection de fait efficace.

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PLANTS OF THE JAMAICAN CAYS

BY

DAVID R. STODDART AND F. RAYMOND FOSBERG

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PLANTS OF THE JAMAICAN CAYS

BY

DAVID R. STODDART[1] AND F. RAYMOND FOSBERG[2]

Abstract

This paper records 105 species in 44 families from the reef islands south of Jamaica (4 islands in the Morant Cays, 4 islands on the Pedro Bank, and 7 islands off Port Royal).

Introduction

This listing of the plants of the Jamaican Cays is based primarily on collections made on the Pedro Cays by Fosberg and M.-H Sachet in 1962, by Stoddart and S.M. Head in the same location in 1985, by Stoddart and Head on the Port Royal Cays in the same year, and by Stoddart, Head, and M.J. Hendry on the Morant Cays, also in 1985. It includes previous records, notably by V.J. Chapman on the Morant and Port Royal cays in 1939 (though we have not seen his specimens) and by C. Bernard Lewis through the 1940's, whose material is in the herbarium of The Institute of Jamaica, Kingston, Jamaica. All the material in The Institute of Jamaica, by various collectors (Table 1), is included in this list.

We record here 105 species in 44 families from 15 islands.

[1]Department of Geography, University of California at Berkeley, Berkeley, CA 94720.

[2]Department of Botany, Smithsonian Institution, Washington, DC 20560.

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AGAVACEAE

Agave rigida Mill.
Agave sisalana Perr.
Portland Bight Cays—Big Pelican Cay: Adams (1969) (as *Agave sisalana* Perr.).

Dracaena sp.
Pedro Bank—Northeast Cay: Stoddart & Head, sight (pot plant).

AIZOACEAE

Sesuvium portulacastrum (L.) J.

Pedro Bank—Northeast Cay: Fosberg 42789, Stoddart & Head 9090, Zans (1958); Middle Cay: Fosberg 42803, Stoddart & Head 9102, Zans (1958); Southwest Cay: Fosberg 42800, Stoddart & Head 9079b, Zans (1958).

Morant Bank—Northeast Cay: Stoddart & Head 9121, Chapman (1944); Northeast Cay north islet: Stoddart & Head 9136; Middle Cay: Stoddart & Head 9142, Chapman (1944), Asprey and Robbins (1953); Southeast Cay: Stoddart & Head 9153, Chapman (1944); Southeast Cay seaward islet: Stoddart & Head 9147; Southwest Cay: Stoddart & Head 9166.

Port Royal Cays—'Cays off Port Royal', no localities, Fl. Jam. II, p. 166; Southeast Cay: Stoddart & Head 9007, 9011, Asprey and Robbins (1953); Southeast Cay separate rampart island: Chapman (1944); Southeast Cay small islet I: Stoddart & Head, sight; Southeast Cay small islet II: Stoddart & Head, sight; Maiden Cay: Chapman (1944), Asprey and Robbins (1953); Rocky Cay: Stoddart & Head 9029; South Cay: Stoddart & Head 9017, Chapman (1944); South Cay small islet: Stoddart & Head 9024; Lime Cay: Wedderburn 305 (IJ), Stoddart & Head 9052, 9064b, Asprey and Robbins (1953), Bengry (1954), Adams in 1963, Kelly in 1977, Brimacombe and Fairbairn in 1979; Gun Cay:

AMARANTHACEAE

Alternanthera halimifolia (Lam.) Standl.
Alternanthera ficoidea var. *flavogrisea* (Urb.) F. & R.
Port Royal Cays—Lime Cay: Stoddart & Head 9048, Adams in 1963.

Portland Bight Cays—Big Pelican Cay: Adams (1969).

Iresine diffusa H. & B. ex Willd.
Portland Bight Cays—Booby Cay: Proctor 33051 (IJ).

Philoxerus vermicularis (L.) Beauv.
Caraxeron vermicularis (L.) Raf.
Pedro Bank—Southwest Cay: Lewis, s.n., 14 June 1947 (IJ).

Morant Bank—Northeast Cay: Lewis, s.n., 28 June 1947 (IJ), Chapman (1944); Middle Cay: Chapman (1944), Asprey and Robbins (1953); Southeast Cay: Chapman (1944) .

Port Royal Cays—Southeast Cay: Chapman (1944), Asprey and Robbins (1953); South Cay: Chapman (1944); Lime Cay: Adams 12348 (UWI), Asprey and Robbins (1953), Kelly in 1977, Brimacombe and Fairbairn in 1979; Drunkenman's Cay: Von der Porten, s.n., 26 May 1949 (IJ), Palmer, s.n., July 1954 (IJ), Wedderburn 299, 15 March 1968 (IJ), Asprey and Robbins (1953); Drunkenman's Cay small islet: Stoddart & Head 9110.

Portland Bight Cays—Pigeon Cay: Proctor 11486, 29 January 1956 (IJ), Cornman, s.n., 17 December 1966 (IJ); Big Pelican Cay: Adams 12266, 19 February 1963 (UWI), Adams (1969).

ANACARDIACEAE

Metopium brownei (Jacq.) Urb.

Rhus metopium L.

Portland Bight Cays—Pigeon Cay: Maxon & Killip, in Fl. Jam. V, p. 9, Proctor 11485, 29 January 1956 (IJ); Big Pelican Cay: Adams (1969).

APOCYNACEAE

Echites umbellata Jacq.

Port Royal Cays—Lime Cay: Adams in 1963, Brimacombe and Fairbairn in 1979.

Portland Bight Cays—Big Pelican Cay: Adams (1969).

Nerium oleander L.

Portland Bight Cays—Big Pelican Cay: Adams (1969).

Vallesia antillana Woodson

Portland Bight Cays—Big Pelican Cay: Adams (1969).

ARECACEAE

Coccothrinax jamaicensis R. W. Read

Portland Bight Cays—Big Pelican Cay: Adams (1969).

Cocos nucifera L.

Pedro Bank—Northeast Cay: Zans (1958), Stoddart & Head, sight; Middle Cay: Stoddart & Head, sight; Southwest Cay: Zans (1958).

Morant Bank—Northeast Cay: Chapman (1944), Stoddart & Head, sight; Middle Cay: Stoddart & Head, sight; Southeast Cay: Chapman (1944).

Portland Bight Cays—Big Pelican Cay: Adams (1969).

ASCLEPIADACEAE

Cynanchum sp.
Metastelma sp.
Portland Bight Cays—Pigeon Cay: Proctor 11672, 4 March 1956 (IJ).

ASTERACEAE

Conyza canadensis (L.) Cronquist
Erigeron pusillus Nutt.
Portland Bight Cays—Pigeon Cay: Proctor 11658, 4 March 1956 (IJ).

Melanthera aspera (Jacq.) L. C. Rich ex Spreng.
Portland Bight Cays—Pigeon Cay: Proctor 11502, 29 January 1956 (IJ).

Wedelia trilobata (L.) Hitchc.
Portland Bight Cays—Big Pelican Cay: Adams (1969).

BATIDACEAE

Batis maritima L.
Port Royal Cays—Southeast Cay: Stoddart & Head 9012, Chapman (1944), Asprey and Robbins (1953); Lime Cay: Fl. Jam. III, p. 35 (old specimen, no data, UWI), Wedderburn 302, 15 March 1968 (IJ), Stoddart & Head 9063, Chapman (1944), Asprey and Robbins (1953), Bengry in 1954, Adams in 1963, Kelly in 1977, Brimacombe and Fairbairn in 1979; Gun Cay: Stoddart & Head 9O74, Chapman (1944); Drunkenman's Cay: Von der Porten, s.n., 25 May 1949 (IJ).

Portland Bight Cays—Pigeon Cay: Proctor 11517, 29 January 1956 (IJ).

BORAGINACEAE

Cordia sebestena L.
Pedro Bank—Southwest Cay: Lewis, s.n., June 1947 (IJ), Von der Porten, s.n., 21 June 1949 (IJ), Fosberg 42796, Stoddart & Head 9082, 9085, Zans (1958).

Port Royal Cays—Lime Cay: Stoddart & Head 9050, Asprey and Robbins (1953), Bengry in 1954, Adams in 1963, Brimacombe and Fairbairn in 1979.

Portland Bight Cays—Pigeon Cay: Proctor 11501, 29 January 1956 (IJ); Big Pelican Cay: Adams (1969).

Heliotropium curassavicum L.

Pedro Bank—Middle Cay: Stoddart & Head 9097; Southwest Cay: Lewis, s.n., June 1950 (IJ), Lewis, s.n., 20 July 1955 (IJ), Fosberg 42794, 42799, Stoddart & Head 9087.

Morant Bank—Northeast Cay: Lewis, s.n., 28 June 1947 (IJ), Lewis, s.n., 18 June 1948 (IJ), Chapman (1944).

Port Royal Cays—Southeast Cay: Asprey and Robbins (1953); Lime Cay: Chapman (1944), Asprey and Robbins (1953); Drunkenman's Cay: Asprey and Robbins (1953).

Tournefortia gnaphalodes (L.) Kunth

Mallotonia gnaphalodes (L.) Britton

Pedro Bank—Northeast Cay: Lewis, s.n., June 1947 (IJ), Fosberg 42791, Stoddart & Head 9093, Zans (1958); Middle Cay: Lewis, s.n., June 1947 (IJ), Fosberg 42806, Stoddart & Head 9101, Zans (1958); Southwest Cay: Lewis, s.n., June 1947 (IJ), Fosberg 42798, Stoddart & Head 9081, Zans (1958).

Morant Bank—'Morant Cays', without localities, Mendez 9200, April 1961 (UWI); Northeast Cay; Chapman (1944), Stoddart & Head 9129; Middle Cay: Stoddart & Head 9144, Chapman (1944), Asprey and Robbins (1953); Southeast Cay: Stoddart & Head 9157; Southeast Cay seaward islet: Chapman (1944); Southwest Cay: Stoddart & Head 9164.

Port Royal Cays—Drunkenman's Cay: Chapman (1944).

Portland Bight Cays—Pigeon Cay: Proctor 11492, 29 January 1956 (IJ).

BURSERACEAE

Bursera lunanii (Spreng.) Adams & Dandy (ined.)

Bursera simplicifolia DC.

Portland Bight Cays—Pigeon Cay: Proctor 11660, 4 March 1956 (IJ).

Bursera simaruba (L.) Sarg.

Portland Bight Cays—Pigeon Cay: Proctor 11662, 4 March 1956 (IJ), Proctor 11482, 29 January 1956 (IJ); Big Pelican Cay: Adams 12268, 19 February 1963 (UWI), Adams 12360, 22 March 1963 (UWI), Adams 12363, 22 March 1963 (UWI), Adams (1969).

CACTACEAE

Cereus sp. (s.l.)

Port Royal Cays—Lime Cay: Stoddart & Head, sight (photograph), juvenile.

Nopalia sp. (?)

Pedro Bank—Middle Cay: Stoddart & Head, sight (photograph), cultivated.

Opuntia dillenii (Ker-Gawl.) Haw.

Portland Bight Cays—Big Pelican Cay: Adams (1969).

Opuntia tuna (L.) Mill.

Morant Bank—Southeast Cay: Chapman (1944), Stoddart & Head, sight.

Port Royal Cays—Lime Cay: Chapman (1944), Asprey and Robbins (1953), Bengry in 1954.

Stenocereus hystrix (Haw.) Buxb.

Lemaireocereus hystrix (Haw.) Britton & Rose

Port Royal Cays—Lime Cay: Adams (1969) in 1963, Kelly in 1977.

CAPPARIDACEAE

Capparis ferruginea L.

Port Royal Cays—Lime Cay: W. T. March, 1857-1858, in Fl. Jam. III, p. 233, Stoddart & Head 9044, 9060, 9069, Asprey and Robbins (1953), Bengry in 1954, Adams in 1963, Kelly in 1977, Brimacombe and Fairbairn in 1979.

Portland Bight Cays—Pigeon Cay: Proctor 11664, 4 March 1956 (IJ); Big Pelican Cay: Adams (1969).

Capparis cynophallophora L.

Port Royal Cays—Lime Cay: Asprey and Robbins (1953).

Portland Bight Cays—Big Pelican Cay: Adams (1969).

Capparis flexuosa (L.) L.

Port Royal Cays—Lime Cay: Adams in 1963, Kelly in 1977, Brimacombe and Fairbairn in 1979.

Portland Bight Cays—Pigeon Cay: Proctor 11663, 4 March 1956 (IJ) (not seen).

CASUARINACEAE

Casuarina equisetifolia L.

Morant Bank—Northeast Cay: Stoddart & Head 9115; Middle Cay: Stoddart & Head, sight (introduced seedling).

Port Royal Cays—Lime Cay: Stoddart & Head 9066, Kelly in 1977, Brimacombe and Fairbairn in 1979.

Portland Bight Cays—Big Pelican Cay: Adams (1969).

CELASTRACEAE

Crossopetalum rhacoma Crantz

Rhacoma crossopetalum L.

Portland Bight Cays—Pigeon Cay: Proctor 11509, 29 January 1956 (IJ).

CHENOPODIACEAE

Atriplex pentandra (Jacq.) Standl.

Portland Bight Cays—Big Pelican Cay: Adams (1969).

COMBRETACEAE

Conocarpus erecta L.

Pedro Bank—Northeast Cay: Stoddart & Head 9120.

Morant Bank—Northeast Cay: Stoddart & Head 9133; Southeast Cay: Stoddart & Head 9151 (var. *sericeus* Griseb.) (introduced).

Port Royal Cays—Southeast Cay: Asprey and Robbins (1953); Southeast Cay separate rampart island: Chapman (1944); South Cay small islet: Stoddart & Head 9025; Lime Cay: Fl. Jam. V, p. 310 (collection dated 1899, UWI), Stoddart & Head 9034, Chapman (1944), Asprey and Robbins (1953), Bengry in 1954, Adams in 1963, Kelly in 1977, Brimacombe and Fairbairn in 1979; Gun Cay: Stoddart & Head 9070, 9072, Chapman (1944); Drunkenman's Cay: Fl. Jam. V, p. 310 (collection dated 1899, UWI), Chapman (1944), Asprey and Robbins (1953).

Portland Bight Cays—Pigeon Cay: Proctor 11484, 29 January 1956 (IJ); Big, Pelican Cay: Adams (1969).

Laguncularia racemosa (L.) Gaertn. f.

Port Royal Cays—Southeast Cay: Asprey and Robbins (1953), Stoddart & Head 9002, 9004, 9008, 9009; Southeast Cay separate rampart island: Chapman (1944); South Cay: Stoddart & Head 9018, 9021, Chapman (1944); Lime Cay: Fl. Jam. V, p. 311 (1899 collection, UWI), Stoddart & Head 9038, 9041, 9059, 9061, Asprey and Robbins (1953), Bengry in 1954, Adams in 1963, Kelly in 1977, Brimacombe and Fairbairn in 1979; Gun Cay: Stoddart & Head 9071, 9073, Chapman (1944); Drunkenman's Cay: Chapman (1944), Asprey and Robbins (1953).

Portland Bight Cays—Pigeon Cay: Proctor 11490, 29 January 1956 (IJ); Big Pelican Cay: Adams (1969).

CONVOLVULACEAE

Ipomoea macrantha Roem. & Schult.

Ipomoea tuba (Schlecht.) G. Don

Calonyction tuba (Schlecht.) G. Don

Morant Bank—'Morant Cays', without locality, Mendes, April 1961 (UWI); Northeast Cay: Lewis, s.n., 19 June 1949 (IJ), Stoddart & Head 9132; Middle Cay: Stoddart & Head 9140; Southeast Cay: Stoddart & Head 9162; Southeast Cay seaward islet: Stoddart & Head 9148; Southwest Cay: Stoddart & Head 9167.

Port Royal Cays—Lime Cay: Loveless, s.n., December 1952 (UWI) Percival, s.n., 28 January 1965 (UWI), Adams 12250, 7 February 1963 (UWI), Asprey and Robbins (1953).

Portland Bight Cays—Pigeon Cay: Proctor 11488, 29 January 1956 (IJ), Cornman 655, 17 December 1966 (IJ); Big Pelican Cay: Adams 12263, 19 February 1963 (UWI), Adams (1969).

Ipomoea pes-caprae (L.) R. Br. ssp. *brasiliensis* (L.) v. Ooststr.

Pedro Bank—Northeast Cay: Stoddart & Head 9088.

Morant Bank—Northeast Cay: Chapman (1944); Middle Cay: Stoddart & Head 9145, Chapman (1944), Asprey and Robbins (1953).

Port Royal Cays—Maiden Cay: Stoddart & Head 9015, Chapman (1944), Asprey and Robbins (1953); Lime Cay: Stoddart & Head 9057, Bengry in 1954, Adams in 1963, Brimacombe and Fairbairn in 1979.

Portland Bight Cays: Pigeon Cay: Proctor 11504, 29 January 1956 (IJ), Proctor 11168, 4 March 1956 (IJ); Big Pelican Cay: Adams (1969).

Jacquemontia havanensis (Jacq.) Urban

Jacquemontia jamaicensis (Jacq.) Hall f.

Portland Bight Cays—Pigeon Cay: Proctor 11512, 29 January 1956 (IJ).

CRUCIFERAE

Cakile lanceolata (Willd.) 0. E. Sch.

Pedro Bank—Northeast Cay: Fosberg 42786.

Morant Bank—'Morant Cays', without locality, Mendes, s.n., April 1961 (UWI); Northeast Cay: Lewis, s.n., 18 June 1948 (IJ), Stoddart & Head 9125, Chapman (1944); Middle Cay: Stoddart & Head 9141, Chapman (1944), Asprey and Robbins (1953); Southeast Cay: Stoddart & Head 9156; Southwest Cay: Lewis, s.n., 28 June 1947 (IJ) .

Port Royal Cays—'House Key, near Port Royal, Sloane Herb. III, 111' (1687-1689), in Fl. Jam. III, p . 245 (identity of this island not established); Maiden Cay: Chapman (1944); Lime Cay: Wedderburn 307 (IJ), Adams 12254, 7 February 1963 (UWI), Asprey and Robbins (1953).

Portland Bight Cays—Pigeon Cay: Proctor 11656, 4 March 1956 (IJ); Big Pelican Cay: Adams (1969); Booby Cay: Proctor 33059, 3 December 1972 (IJ).

CUCURBITACEAE

Citrullus lanatus var. *caffrorum* (Alefeld) Fosb.

Morant Bank—Northeast Cay: Stoddart & Head 9114 (cultivated).

Port Royal Cays—Lime Cay: Stoddart & Head 9058.

Cucurbita sp.

Morant Bank—Northeast Cay: Stoddart & Head 9113 (sterile) (cultivated).

Doveria emetocathartica Grosourdy

Port Royal Cays—Lime Cay: Adams in 1963 (seedlings).

CYPERACEAE

Cyperus ligularis L.

Mariscus rufus Kunth

Morant Bank—Northeast Cay: Chapman (1944) (probably *Cyperus planifolius* L. C. Rich).

Cyperus planifolius L. C. Rich

Pedro Bank—Northeast Cay: Fosberg 42788 (IJ), Stoddart & Head 9091, Zans (1958); Middle Cay: Fosberg 42802 (IJ), Stoddart & Head 9099, Zans (1958); Southwest Cay: Fosberg 42797 (IJ), Stoddart 9084), Zans (1958).

Morant Bank—'Morant Cay', Lodge, s.n., 25 May 1965 (UWI); Northeast Cay: Stoddart & Head 9127, probably also as C. *ligularis* L. in Chapman (1944).

Portland Bight Cays—Big Pelican Cay: Adams 12272, 12273, 19 February 1963 (UWI), 13043, 13044, 29 October 1967 (UWI), Adams (1969).

EUPHORBIACEAE

Ateramnus lucidus (Sw.) Rothm.

Gymnanthes lucida Sw.

Port Royal Cays—Lime Cay: Adams (1969) (rare).

Bernardia dichotoma (Willd.) Muell. Arg.
Portland Bight Cays—Pigeon Cay: Proctor 11666, 4 March 1956 (IJ).

Euphorbia blodgettii Engelm.ex Hitchc.
Chamaesyce blodgettii (Engelm.ex Hitchc.) Small
Port Royal Cays—Lime Cay: Adams 12750, 28 November 1965 (UWI), Kelly, s.n., January,1977 (UWI), Stoddart & Head 9053, Asprey and Robbins (1953), Brimacombe and Fairbairn in 1979.

Portland Bight Cays—Pigeon Cay: Proctor 11494, 29 January 1956 (IJ).

Euphorbia mesembrianthemifolia Jacq.
Euphorbia buxifolia Lam.
Chamaesyce buxifolia (Lam.) Small
Morant Bank—Northeast Cay: Stoddart & Head 9128; Southeast Cay: Stoddart & Head 9159.

Port Royal Cays—Maiden Cay: Chapman (1944), Asprey and Robbins (1953); Lime Cay: Barry, s.n., 31 March 1946 (IJ), Palmer, s.n., October 1952 (UWI), Patrick 86, 17 January 1954 (IJ), Wedderburn 298, 15 March 1968 (IJ), Stoddart & Head 9056, Chapman (1944), Asprey and Robbins (1953), Bengry in 1954, Adams in 1963, Kelly in 1977, Brimacombe and Fairbairn in 1979; Gun Cay: Sloane Herb. III, 118, in Fl. Jam. IV, p. 336; Drunkenman's Cay: Chapman (1944).

Portland Bight Cays—Pigeon Cay: Proctor 11514, 29 January 1956 (IJ); Big Pelican Cay: Adams (1969).

Lasiocroton macrophyllus (Sw.) Griseb.
Portland Bight Cays—Pigeon Cay: Proctor 11661, 4 M.arch 1956 (IJ).

FABACEAE

Acacia tortuosa (L.) Willd.
Port Royal Cays—Lime Cay: Palmer, s.n., October 1952 (UWI), Wedderburn 308, 15 March 1968 (IJ), Stoddart & Head 9040, 9045, 9062, Chapman (1944) (as Acacia sp.), Asprey and Robbins (1953), Bengry in 1954, Adams in 1963, Kelly in 1977, Brimacombe and Fairbairn in 1979 .

Caesalpinia bonduc (L.) Roxb.
Caesalpinia crista L.
Guilandina bonduc L.
Port Royal Cays—Lime Cay: Asprey, s.n., 1951 (UWI), Asprey and Robbins (1953), Bengry in 1954, Adams in 1963, Kelly in 1977.

Port and Bight Cays—Pigeon Cay: Proctor 11671, 4 March 1956 (IJ); Big Pelican Cay: Adams (1969).

Canavalia maritima (Aubl.) Urb.
Canavalia obtusifolia (Lam.) DC.
Canavalia rosea (Sw.) DC.
Pedro Bank—Northeast Cay: Stoddart & Head 9095 (seedling).

Morant Bank—Northeast Cay: Stoddart & Head 9134.

Port Royal Cays—Maiden Cay: Asprey and Robbins (1953) (two plants); Lime Cay: Fl. Jam. IV, p. 60 (collection dated 1899, UWI), Asprey and Robbins (1953), Bengry in 1954, Adams in 1963 (seedling), Kelly in 1977.

Portland Bight Cays—Pigeon Cay: Proctor 11489, 29 January 1956 (IJ); Big Pelican Cay: Adams 1969).

Cassia emarginata L.
Port Royal Cay—Lime Cay: Asprey, s.n., July 1952 (UWI), Wedderburn 309, 15 March 1968 (IJ), Stoddart & Head 9036, Asprey and Robbins (1953), Bengry in 1954, Brimacombe and Fairbairn in 1979.

Crotalaria incana L.
Port Royal Cays—Lime Cay: Adams in 1963 (rare).

Delonix regia (Boj. ex Hook.) Raf.
Portland Bight Cays—Big Pelican Cay: Adams (1969).

Indigofera tinctoria L.
Port Royal Cays—Lime Cay: Asprey and Robbins (1953), Adams in 1963, Kelly in 1977, Brimacombe and Fairbairn in 1979.

Portland Bight Cays—Pigeon Cay: Proctor 11515, 29 January 1956 (IJ)

Piscidia piscipula (L.) Sarg.
Port Royal Cays—Maiden Cay: Fl. Jam. IV, p. 84 (1899 specimen, UWI); Lime Cay: Adams 12249, 7 February 1963 (UWI), Adams (1969), Asprey and Robbins (1953), Bengry in 1954.

Pithecellobium unguis-cati (L.) Benth.
Port Royal Cays—Lime Cay: Stoddart & Head 9046, Asprey and Robbins (1953), Bengry in 1954, Adams in 1963, Adams (1969), Kelly in 1977, Brimacombe and Fairbairn in 1979.

Tephrosia cinerea (L.) Pers.
Port Royal Cays—Lime Cay: Stoddart & Head 9055, Adams in 1963, Brimacombe and Fairbairn in 1979.

Vigna luteola (Jacq.) Benth.
Vigna repens Ktze.
Locality unknown–'Green Island': Fl. Jam. IV, p. 67 (as *Vigna repens* Ktze.).

Leguminosae sp. indet.
Port Royal Cays—Gun Cay: Chapman (1944).

GOODENIACEAE

Scaevola plumieri (L.) Vahl

Port Royal Cay—Lime Cay: Barry, s.n., 31 March 1946 (IJ), Patrick 87, 17 January 1954 (IJ), Adams 12256, 7 February 1963 (UWI), Wedderburn 310, 15 March 1968 (IJ), Stoddart & Head 9051, Asprey and Robbins (1953), Kelly in 1977, Brimacombe and Fairbairn in 1979.

HYDROCHARITACEAE

Halophila decipiens Ostenf.
Port Royal Cays—Southeast Cay: Woodley, s.n., 7 December 1969, depth 30 m (IJ) (det. G. R. Proctor).

Thalassia testudinum König
Morant Bank—Northeast Cay: Stoddart & Head 9118.

Port Royal Cays—Southeast Cay: Stoddart & Head 9005; South Cay: Stoddart & Head 9016; Lime Cay: Von der Porten, s.n., 27 May 1950 (IJ), Stoddart & Head 9031; Drunkenman's Cay: Stoddart & Head 9105.

LAURACEAE

Cassytha filiformis L.
Portland Bight Cays—Pigeon Cay: Proctor 11500, 29 January 1956 (IJ), Rankin (1955).

MALPIGHIACEAE

Stigmaphyllon emarginatum (Cav.) A. Juss.
Port Royal Cays—Lime Cay: Adams in 1963 (rare) (IJ), Adams (1969).

MALVACEAE

Gossypium hirsutum L. var. *marie-galante* (Watt.) J.B. Hutch.
Portland Bight Cays—Big Pelican Cay: Adams (1969).

Thespesia populnea (L.) Sol. ex Correa
Port Royal Cays—Southeast Cay: Stoddart & Head 9010, Asprey and Robbins (1953) (one plant); Rocky Cay: Stoddart & Head 9026; South Cay: Stoddart & Head 9022, Chapman (1944); South Cay small islet: Stoddart & Head 9023; Lime Cay: Stoddart & Head 9033, 9068, Chapman (1944), Asprey and Robbins (1953), Adams in 1963, Adams (1969), Brimacombe and Fairbairn in 1979; Gun Cay: Stoddart & Head 9076, Chapman (1944); Drunkenman's Cay: (Gibbs, Grant, Massop and Thomas, s.n., 1 October 1953 (IJ), Chapman (1944), Asprey and Robbins (1953).

Portland Bight Cays—Pigeon Cay: Proctor 11505, 29 January 1956 (IJ); Big Pelican Cay: Adams 13047, 29 October 1967 (UWI).

NYCTAGINACEAE

Boerhavia coccinea Mill.

Boerhavia hirsuta Willd.

Morant Bank—Northeast Cay: Lewis, s.n., 28 June 1947 (IJ) (det. F. R. Fosberg), Chapman (1944); Middle Cay: Chapman (1944), Asprey and Robbins (1953); Southeast Cay: Stoddart & Head 9152.

Port Royal Cays—Lime Cay: Asprey and Robbins (1953), Adams in 1963, Kelly in 1977, Brimacombe and Fairbairn in 1979.

Portland Bight Cays—Pigeon Cay: Proctor 11483, 29 January 1956 (IJ) (as *Boerhavia hirsuta* Willd.); Big Pelican Cay: Adams 12274, 19 February 1963 (UWI), Adams (1969).

Boerhavia paniculata L. C. Rich

Morant Bank—Northeast Cay: Stoddart & Head 9122; Middle Cay: Stoddart & Head 9138; Southeast Cay: Stoddart & Head 9152.

Boerhavia scandens L.

Commicarpus scandens (L.) Standley

Port Royal Cays—Lime Cay: Stoddart & Head 9065.

Guapira obtusata (Jacq.) Little

Torruhia obtusata (Jacq.) Britton

Portland Bight Cays—Big Pelican Cay: Adams (1969).

PASSIFLORACEAE

Passiflora suberosa L.

Port Royal Cays—Lime Cay: Fawcett, s.n., 1899 (UWI), Robbins, s.n., July 1952 (UWI), Adams 12258, 7 February 1963 (UWI), Asprey and Robbins (1953).

Portland Bight Cays—Pigeon Cay: Proctor 11667, 4 March 1956 (IJ).

PHYTOLACCACEAE

Rivina humilis L.

Portland Bight Cays—Big Pelican Cay: Carter, s.n., 12 November 1963 (UWI), Adams 13037, 29 October 1967 (UWI), Adams (1969).

Trichostigma octandrum (L.) H. Walt.
Portland Bight Cays—Big Pelican Cay: Adams (1969).

POACEAE

Cenchrus brownii Roem. & Schult.
Portland Bight Cays—Big Pelican Cay: Adams (1969).

Cenchrus echinatus L.
Cenchrus tribuloides L.
Morant Bank—'Morant Cays', without locality, Lewis, s.n., 14 June 1947 (IJ); Northeast Cay: Stoddart & Head 9131, Chapman (1944).

Port Royal Cays—Lime Cay: Stoddart & Head 9064a.

Portland Bight Cays—Big Pelican Cay: Adams (1969).

Chloris mollis (Nees) Swallen
Port Royal Cays—Lime Cay: Adams in 1979 (rare).

Eragrostis domingensis (Pers.) Steud.
Pedro Bank—Middle Cay: Stoddart & Head 9096.

Eustachys petraea (Sw.) Desv.
Chloris petraea Sw.
Portland Bight Cays—Pigeon Cay: Proctor 11503, 29 January 1956 (IJ).

Panicum maximum Jacq.
Portland Bight Cays—Big Pelican Cay: Adams (1969).

Paspalum distichum L.
Paspalum vaginatum Sw.
Pedro Bank—Northeast Cay: Fosberg 42789, Stoddart & Head 9092; Southwest Cay: Lewis, s.n., 14 June 1947 (IJ), Lewis, s.n., June 1950 (IJ), Fosberg 42798, Stoddart & Head 9083, Zans (1958).

Morant Bank—Northeast Cay: Lewis, s.n., 28 June 1947 (IJ), Lewis, s.n., 19 June 1949 (IJ), Stoddart & Head 9130; Middle Cay: Stoddart & Head 9143, Chapman (1944); Southeast Cay seaward islet: Stoddart & Head 9149; Southwest Cay: Lewis, s.n., 19 June 1949 (IJ), Lewis, s.n., June 1950 (IJ), Stoddart & Head 9168.

Port Royal Cays—Maiden Cay: Asprey and Robbins (1953) (one plant).

Portland Bight Cays—Big Pelican Cay: Adams 13038, 29 October 1967 (UWI), Adams (1969).

Sporobolus virginicus (L.) Kunth

Pedro Bank—Middle Cay: Stoddart & Head 9098.

Morant Bank—Northeast Cay: Lewis, s.n., 28 June 1947 (IJ), Lewis, s.n., 18 June 1948 (IJ), Stoddart & Head 9117, Chapman (1944); Middle Cay: Stoddart & head 9139, Chapman (1944), Asprey and Robbins (1953); Southeast Cay: Stoddart & Head 9154, Chapman (1944); Southeast Cay seaward islet: Stoddart & Head 9150.

Port Royal Cays—Southeast Cay: Asprey and Robbins (1953); Maiden Cay: Chapman (1944), Asprey and Robbins (1953); Lime Cay: Asprey, s.n., November 1951 (UWI), Stoddart & Head 9032, 9035, 9039, Asprey and Robbins (1953), Bengry in 1954, Adams in 1963, Kelly in 1977, Brimacombe and Fairbairn in 1979; Gun Cay: Stoddart & Head 9078, Chapman (1944); Drunkenman's Cay: Chapman (1944), Asprey and Robbins (1953); Drunkenman's Cay small islet: Stoddart & Head 9109.

Portland Bight Cays—Big Pelican Cay: Adams (1969).

PORTULACACEAE

Portulaca oleracea L.

Pedro Bank—Northeast Cay: Fosberg 42790, Stoddart & Head 9089, Zans (1958); Middle Cay: Fosberg 42804, Stoddart & Head 9103, Zans (1958); Southwest Cay: Fosberg 42801, Stoddart & Head 9080, Zans (1958).

Morant Bank—Northeast Cay: Lewis, s.n., 28 June 1947 (IJ) (not seen), Stoddart & Head 9135, Chapman (1944); Middle Cay: Asprey and Robbins (1953), Stoddart & Head 9137; Southeast Cay: Stoddart & Head 9160, Chapman (1944); Southeast Cay seaward islet: Stoddart & Head 9146; Southwest Cay: Stoddart & Head 9165.

Port Royal Cays—Lime Cay: Wedderburn 304, 15 March 1968 (IJ), Stoddart & Head 9037, 9054, Brimacombe and Fairbairn in 1979.

Portland Bight Cays—Big Pelican Cay: Adams (1969).

Portulaca pilosa L.

Port Royal Cays—'Cays outside Port Royal, Macfadyen' (J. Macfadyen, 1825-1850), without localities, Fl. Jam. III, p. 170.

Portulaca rubricaulis Kunth

Portland Bight Cays—Pigeon Cay: Proctor 11670, 4 March 1956 (IJ).

POLYGONACEAE

Coccoloba uvifera L.

Port Royal Cays—Lime Cay: Stoddart & Head 9043, Asprey and Robbins (1953), Bengry in 1954, Adams in 1963, Brimacombe and Fairbairn in 1979.

RHAMNACEAE

Colubrina asiatica (L.) Brongn.

Port Royal Cays—Lime Cay: Adams 12248, 7 February 1963 (UWI) (very rare), Kelly in 1977.

Portland Bight Cays—Pigeon Cay: Proctor 11506, 29 June 1956 (IJ); Big Pelican Cay: Adams (1969).

RHIZOPHORACEAE

Rhizophora mangle L.

Morant Bank—Northeast Cay: Stoddart & Head 9112 (juveniles, introduced).

Port Royal Cays—Southeast Cay: Stoddart & Head 9001, 9014, Asprey and Robbins (1953); Southeast Cay separate rampart: island: Chapman (1944); Rocky Cay: Stoddart & Head 9028; South Cay: Stoddart & Head 9020, Chapman (1944); Lime Cay: specimen, no data (ca 1899) (UWI), Wedderburn 300, 15 March 1968 (IJ), Stoddart & Head 9049, Chapman (1944), Asprey and Robbins (1953), Bengry in 1954, Adams in 1963, Kelly in 1977, Brimacombe and Fairbairn in 1979; Gun Cay: Chapman (1944); Drunkenman's Cay: Stoddart & Head 9106, Chapman (1944), Asprey and Robbins (1953).

Portland Bight Cays—Pigeon Cay: Proctor 11511, 29 January 1956 (IJ), Steers (1940); Big Pelican Cay: Steers (1940) (seedlings), Adams (1969) (seedlings); Salt Cay: Steers (1940).

RUBIACEAE

Erithalis fruticosa L.

Portland Bight Cays—Pigeon Cay: Proctor 11513, 29 January 1953 (IJ).

Ixora ferrea Benth.

Port Royal Cays—Lime Cay: Stoddart & Head 9067 (?).

Morinda citrifolia L.

Port Royal Cays—Lime Cay: Asprey and Robbins (1953).

Portland Bight Cays—Pigeon Cay: Proctor 11487, 29 January 1956 (IJ).

Morinda royoc L.

Port Royal Cays—Lime Cay: Adams 12253, 7 February 1963 (UWI), Asprey and Robbins (1953), Brimacombe and Fairbairn in 1979.

SOLANACEAE

Solanum bahamense L.

Portland Bight Cays—Big Pelican Cay: Adams (1969).

STERCULIACEAE

Waltheria indica L.

Portland Bight Cays—Pigeon Cay: Proctor 11499, 29 January 1956 (IJ).

SURIANACEAE

Suriana maritima L.

Pedro Bank—Northeast Cay: Fosberg 42792, Stoddart & Head 9094, Zans (1958); Middle Cay: Lewis, s.n., 14 June 1947 (IJ), Fosberg 42805, Stoddart & Head 9100, Zans (1958); Southwest Cay: Fosberg 42793, Stoddart & Head 9086, Zans (1958).

Morant Bank—'Morant Cays', without localities, Mendes, s.n., April 1961 (UWI); Northeast Cay: Stoddart & Head 9126; Southeast Cay: Stoddart & Head 9158.

Port Royal Cays—'Cays off Port Royal', no localities or collector, 1899 (UWI); 'House Key, near Port Royal', Fl. Jam. IV, p. 197 (identity of this island not established).

Portland Bight Cays—Pigeon Cay: Proctor 11516, 29 January 1956 (IJ) (not seen); Big Pelican Cay: Adams (1969).

TURNERACEAE

Turnera ulmifolia L.

Morant Bank—Northeast Cay: Stoddart & Head 9116, Chapman (1944); Middle Cay: Chapman (1944), Asprey and Robbins (1953); Southeast Cay: Stoddart & Head 9163.

Portland Bight Cays—Pigeon Cay: Proctor 11498, 29 January 1956 (IJ); Big Pelican Cay: Adams (1969).

VERBENACEAE

Avicennia germinans (L.) L.

Avicennia nitida Jacq.

Port Royal Cays—Southeast Cay: Stoddart & Head 9003, 9013, Asprey and Robbins (1953); Southeast Cay separate rampart island: Chapman (1944); Rocky Cay: Stoddart & Head 9027, 9030; South Cay: Stoddart & Head 9019, Chapman (1944); Lime Cay: Wedderburn 301, 15 March 1968 (IJ), Stoddart & Head 9042, Chapman (1944), Asprey and Robbins (1953), Bengry in 1954, Adams in 1963, Kelly in 1977, Brimacombe and Fairbairn in 1979; Gun Cay: Stoddart & Head 9079a, Chapman (1944); Drunkenman's Cay: Palmer, s.n., July 1954 (UWI), Stoddart & Head 9108, Chapman (1944), Asprey and Robbins (1953).

Portland Bight Cays—Pigeon Cay: Proctor 11493, 29 January 1956 (IJ); Big Pelican Cay: Steers (1940), Adams (1969); Salt Cay Steers (1940).

Citharexylum fruticosum L.

Portland Bight Cays—Big Pelican Cay: Adams (1969).

Lantana involucrata L.

Portland Bight Cays—Pigeon Cay: Proctor 11510, 29 January 1956 (IJ).

Stachytarpheta jamaicensis (L.) Vahl

Port Royal Cays—Lime Cay: Adams 12255, 7 February 1963 (UWI).

Portland Bight Cays—Pigeon Cay: Proctor 11807, 29 January 1956 (IJ); Big Pelican Cay: Adams 12265, 19 February 1963 (UWI), Adams (1969).

ZOSTERACEAE

Halodule beaudettei (den Hartog) den Hartog

Port Royal Cays—Lime Cay: Barry, s.n., 12 June 1945 (IJ).

Halodule wrightii Aschers., s.l.

Port Royal Cays—Southeast Cay: Stoddart & Head 9006.

Syringodium filiforme Kütz.

Cymodocea manatorum Aschers.

Morant Bank—Northeast Cay: Stoddart & Head 9119.

Port Royal Cays—Southeast Cay: Stoddart & Head 9006; Drunkenman's Cay: Stoddart & Head 9104.

ZYGOPHYLLACEAE

Kallstroemia maxima (L.) Torr. & A. Gray

Morant Bank—Northeast Cay: Stoddart & Head 9123.

Port Royal Cays—Lime Cay: Brimacombe and Fairbairn in 1979.

Tribulus cistoides L.

Morant Bank—Northeast Cay: Stoddart & Head 9124, Chapman (1944); Southeast Cay: Stoddart & Head 9161, Chapman (1944).

Port Royal Cays—Maiden Cay: Chapman (1944); Lime Cay: Wedderburn 306, 15 March 1968 (IJ), Chapman (1944), Asprey and Robbins (1953), Bengry in 1954, Adams in 1963, Kelly in 1977, Brimacombe and Fairbairn in 1979; Gun Cay: Chapman (1944).

Portland Bight Cays—Pigeon Cay: Proctor 11655, 4 March 1956 (IJ); Big Pelican Cay: Adams (1969).

Table 1. Collectors and observers of plants on the Jamaica cays

1687-1689		Hans Sloane	'House Key', Gun Cay
1825-1850		J. Macfadyen	Port Royal Cays
1857-1858		W. T. March	Lime Cay
1899		W. Fawcett	Lime Cay, Maiden Cay, 'Green Cay'
1939		V. J. Chapman J. A. Steers	Port Royal Cays, Morant Cay
1940	April, June	C. B. Lewis	Pedro Cays, Morant Cays
1945	12 June	A. M. Barry	Lime Cay
1946	31 March	A. M. Barry	Lime Cay
1947	14 June 28 June 29 June	C. B. Lewis	Pedro Cays Morant Cays Pedro Cays
1948	18 June	C. B. Lewis	Morant Cays
1949	26 May	A. von der Porten	Drunkenman's Cay
1949	19 June	C. B. Lewis	Morant Cays
1949	21 June	A. von der Porten	Pedro Cays
1949	26 June	A. von der Porten	Drunkenman's Cay
1950	27 May	A. von der Porten	Lime Cay
1950	June	C. B. Lewis	Pedro Cays, Morant Cays
1951	November	G. F. Asprey	Lime Cay
1952	July	G. F. Asprey R. G. Robbins	Lime Cay
1952	December	A. R. Loveless	Lime Cay
1953	1 October	R. Gibbs, E. Grant A. Massop, A. Thomas	Drunkenman's Cay
1954	17 January	R. P. Bengry L. A. Patrick	Lime Cay

1954	July October	J. H. Palmer	Drunkenman's Cay Lime Cay
1955	20 July	C. B. Lewis	Pedro Cays
1955	18-23 July	V. A. Zans	Pedro Cays
1955	October	J. Rankin	Pigeon Cay
1956	February	B. V. Bailey	Pedro Cays
1956	November	V. A. Zans B. V. Bailey	Pedro Cays
1956	29 January 4 March	G. R. Proctor	Pigeon Cay
1957	January	B. V. Bailey	Pedro Cay
1961	April	D. Mendes	Morant Cays
1962	18-22 July	F. R. Fosberg M.-H. Sachet T. F. Goreau	Pedro Cays
1963	7 February	C. D. Adams	Lime Cay
1963	19 February 22 March	C. D. Adams	Big Pelican Cay
1963	12 November	W. Carter	Big Pelican Cay
1965	25 May	E. Lodge	Morant Cays
1965	28 November	C. D. Adams	Lime Cay
1966	17 December	I. Cornman	Pigeon Cay
1967	29 October	C. D. Adams	Big Pelican Cay
1968	15 March	M. M. Wedderburn	Lime Cay, Drunkenman's Cay
1969	7 December	J. D. Woodley	Southeast Cay (Port Royal Cays)
1972	3 December	G. R. Proctor	Booby Cay
1977	January	D. L. Kelly	Lime Cay
1979	28 July	M. Brimacombe P. Fairbairn	Lime Cay
1985	15-26 October	D. R. Stoddart S. M. Head M. C. Hendry (part)	Pedro Cays, Morant Cays, Port Royal Cays

Acknowledgements

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LIVING AND LATE HOLOCENE FOSSIL VERTEBRATES, AND THE VEGETATION OF THE COCKPIT COUNTRY, JAMAICA

BY

GREGORY K. PREGILL, RONALD I. CROMBIE, DAVID W. STEADMAN, LINDA K. GORDON, FRANK W. DAVIS, AND WILLIAM B. HILGARTNER

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LIVING AND LATE HOLOCENE FOSSIL VERTEBRATES, AND THE VEGETATION OF THE COCKPIT COUNTRY, JAMAICA

BY

GREGORY K. PREGILL[1], RONALD I. CROMBIE[2], DAVID W. STEADMAN[3], LINDA K. GORDON[4], FRANK W. DAVIS[5], AND WILLIAM B. HILGARTNER[6]

The Cockpit Country of west central Jamaica encompasses more than 500 km^2 of luxuriant forest that blankets a spectacular terrain of conical hills, valleys, caves, and escarpments (Fig. 1). These karst features are developed in the White Limestone Formation of mid-Eocene to mid-Miocene age (Arden, 1975). The extent of the Cockpits is approximately 20 miles east-west and 10 miles north-south, and is more or less centered in Trelawny Parish. Portions extend briefly into St. James Parish (west) and into St. Elizabeth and Manchester parishes to the south. As yet, no roads transect the central Cockpits and, for the most part, even the periphery is sparsely settled. Consequently, the forest is remarkably pristine for the West Indies and stands in sobering contrast to Jamaica's largely crowded, cultivated and eroded landscape. Although endemic species of invertebrates and amphibians are known from the Cockpits, the region remains poorly explored biologically.

In June 1983, we entered the southern Cockpits near the village of Quickstep, Trelawny Parish, with two goals in mind: to excavate cave sediments for vertebrate fossils and to describe the region's predominant species of plants and vertebrates. Our fossil locality was a large

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[1] Department of Herpetology, San Diego Natural History Museum, P.O. Box 1390, San Diego, CA 92112

[2] Division of Amphibians and Reptiles, National Museum of Natural History, Smithsonian Institution, Washington, DC 20560

[3] New York State Museum, The State Education Department, Albany, NY 12230

[4] Division of Mammals, National Museum of Natural History, Smithsonian Institution, Washington, DC 20560

[5] Department of Geography, University of California, Santa Barbara, CA 93106

[6] Department of Geography and Environmental Engineering, The Johns Hopkins University, Baltimore, MD 21218

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cave that had been located by Crombie in 1971 during his herpetological reconnaissance of the Cockpits (Crombie, 1977, 1986). Unlike many large caves in Jamaica that lost their paleontological potential to phosphate or bauxite mining during and since WWII, the cave found by Crombie was undisturbed. Known as Marta Tick Cave, it is isolated deep in the forest amid steep, inhospitable terrain approximately 8 km WNW of Quickstep. The cave is reached by an obscure 2 km trail that begins on the Cockpit Road 6 km north of Quickstep. Because daily trips to and from the village were not feasible, we established camp in the cave itself.

For three weeks we excavated sediment within the cave, while for the entire four weeks of our stay we also pursued our second goal, to make observations and collections of the plants and animals of the surrounding forest. Such a survey would allow interpretation of the fossil fauna as well as document the current status of the local biota. Specimens of fossil and living vertebrates were deposited in the collections of the National Museum of Natural History, Smithsonian Institution, and the San Diego Natural History Museum. Plant specimens were deposited in the herbaria of the University of the West Indies, Kingston, Jamaica, and the Department of Biological Sciences, University of California, Santa Barbara.

Considering that very few areas of undisturbed forest remain in Jamaica, or elsewhere in the Caribbean, our inventory of this relatively undisturbed portion of the Cockpits should be a reliable baseline for future comparisons. As seems to be the case for Amazonia (Roberts, 1988), the natural areas that are not saved in Jamaica within the next decade may be so damaged by the turn of the century that many species will be lost. With this in mind, we hope that the results of our survey of the very rich biota of the Cockpits will contribute to its preservation in a natural state.

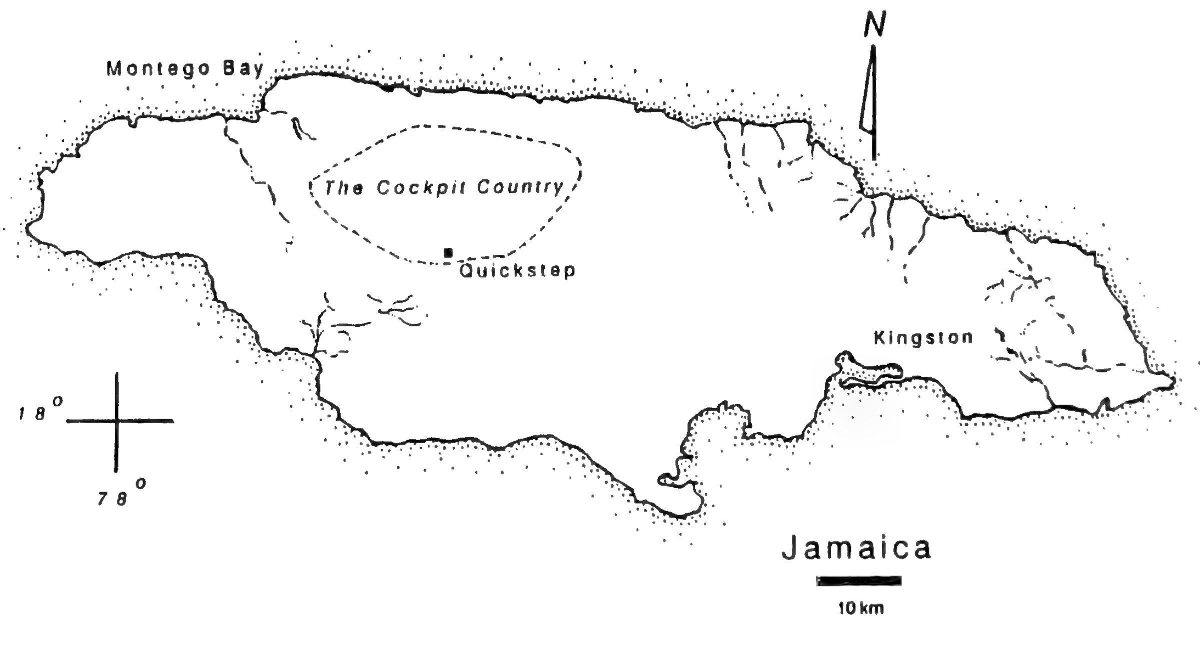

Figure 1. Jamaica, showing the general extent of the Cockpit Country.

THE CAVE

The entrance of Marta Tick Cave is a large, semicircular opening, 11.3 m wide, on the southern face of a steep slope. The opening empties into a roughly circular main chamber about 15.5 m in diameter. At its highest, the ceiling reaches 7 m, and is scarred with shallow cavities that serve as roosting sites for Cave Swallows, *Hirundo fulva*. To the left (WSW) of the main chamber is a broad ledge approximately 1 m above the cave floor, 13 m wide, 8 m deep, and partially divided by a large flowstone pillar. To the right (NNE) is a massive, floor-to-ceiling flowstone wall that terminates near the entrance in a large pile of rock and rubble. The rear wall of the main chamber forms from the gradually sloping ceiling; to the west and north two main passages lead into the deep recesses of the cave. After our visit in 1983, the cave was mapped in detail by a party from the National Speleological Society, and most of the 800 m of passage are now known (Baker et al., 1986).

CAVE EXCAVATION

After an extensive search for surface remains, six test pits were dug in selected areas of the main chamber where dry sediment had accumulated. Test pits measured 1' x 3' and were excavated to varying depths depending on the quality and thickness of the sediment. Sediment was passed simultaneously through 1/4" and 1/16" mesh screens. The deepest test pits were near the middle of the chamber floor. They were poorly stratified with an upper layer 10-12" thick of powdery reddish brown sediment, below which was 18-24" of dense, yellowish brown loam that rested on bedrock or breccia. Most of the test pits did not yield great numbers of fossils. The most productive fossil-producing areas of the cave were several pockets at the back of the broad ledge that extends northwest from the main chamber against the north wall. One of these pockets was packed with bone in a crystalline sandy matrix, 15-20 cm thick, about 7' wide, and cemented with countless aggregates of osteoderms--the bony scales of diploglossine lizards. This site produced over 200 lbs of screened, concentrated matrix. The second most productive site was another pocket at the back of the same ledge, about 6 m west of the first pocket. Radiocarbon ages on charcoal were obtained from both of these deposits.

SAMPLING PLANTS AND VERTEBRATES

Our 1983 excursion into the Cockpits coincided with the advent of summer rains, which produced conditions ideal for vertebrate activity, especially amphibians. At this time of year, however, the rugged limestone terrain is muddy and difficult to traverse, and the forest abounds in mosquitoes and biting insects.

We collected plant specimens along transects that radiated from the cave entrance, and at five other sites within the forest at distances of 70 to 300 m from the cave. At six sites within 150 m of the cave, we erected one or two 12 m mist nets to capture birds and bats. The nets were monitored hourly during daylight hours, and from four to five times after dark. Bats were also netted at the cave entrance during twilight.

Amphibians and reptiles were collected during the day and at night, usually by turning rocks and logs, examining bromeliads, and systematically searching perch sites and leaf litter adjacent to the trails and transects.

RESULTS

1. Vertebrate Fossils

In the laboratory, thousands of bones and fragments were recovered from the concentrated matrix. Radiocarbon ages on wood charcoal were obtained from the University of Arizona Laboratory of Isotope Geochemistry, as follows: pocket 1) 770 ± 70 years BP (A-4087), pocket 2) 20 ± 70 years BP (modern; A-4088). Although most of the fossil bones are well mineralized, the composition of species represented by them further suggests that the bones were deposited within late Holocene times and accord with the radiocarbon ages. For example, there are no species of heptaxodontid rodents, which are known from late Pleistocene sites elsewhere in Jamaica (MacPhee, 1984), nor are there flightless ibises, which have been associated with the extinct primate *Xenothrix* at Long Mile Cave, Trelawny Parish (Olson and Steadman, 1977). Practically all of the fossils represent species that can be found in or about the southern Cockpits today, and no further comment on them is made here (Table 1). There are, however, a few interesting exceptions.

Nearly 90% of the paleofauna consists of squamate reptiles, the majority of which are lizards. Noteworthy is a giant galliwasp represented by cranial and postcranial elements which possibly is referable to *Celestus occiduus*. This lizard presumably has become extinct within this century. When he wrote *The Herpetology of Jamaica* with W. Gardner Lynn in 1940, Chapman Grant insisted that they still existed, a view opposed by other authors (Barbour, 1910; Cousens, 1956; Schwartz, 1970, 1971). Grant offered no locality information. In the Marta Tick paleofauna, the large *Celestus* is abundant, although the minimum number of individuals and frequency relative to other taxa have not been calculated.

Few preserved specimens of *Celestus occiduus* exist in museum collections (only three in North America), and the species' original distribution on Jamaica is unclear. Barbour (1910) discussed three specimens that supposedly came from Mandeville, and Gosse (1851) noted only that they were to be found in the Great Morass of Westmoreland Parish, where they provoked fear and disgust among locals. Males of *C. occiduus* collected in the 19th century attained a snout-vent length of 305 mm (Schwartz, 1971). Many of the fossils from Marta Tick Cave represent individuals at least this size.

A second fossil lizard of interest from Marta Tick Cave is the extinct tropidurid *Leiocephalus* cf. *L. jamaicensis*. This species was known previously only by fossils from Dairy Cave and Montego Bay Airport Cave on the north coast, and from the Portland Ridge Caves southwest of Kingston (Etheridge, 1966). More than one species, however, may be represented by these fossils (Pregill, in press), including *L. jamaicensis*. We found scattered remains of *Leiocephalus* in various layers of sediment, but of more interest were the unmineralized bones recovered from

the cave floor. These essentially contemporaneous skeletal remains suggest that *Leiocephalus* survived until very recently, probably historically, but was never detected by the early European naturalists that explored Jamaica. Such was the case for other extinct species of *Leiocephalus* that are known from Holocene deposits in the Lesser Antilles (Pregill et al., 1988; Pregill, in press).

Because *Leiocephalus* was a recent resident of the Cockpits, we might infer that the species itself (be it *jamaicensis* or something else) was much more mesophytic than most other species of the genus. Although it is highly unlikely that the humid climate and lush vegetation of the southern Cockpits have changed significantly in the past few hundred years, *Ameiva dorsalis*, another open-country species of lizard, also occurs in the Marta Tick deposits but is found nowhere near the Cockpits today. Hence, there is some faunal evidence to suggest that the presently dense primary forest of the Cockpits might in fact be of recent origin.

The scant fossil record of birds from Jamaica includes an extinct flightless ibis (*Xenicibis xympithecus*), an extinct or extirpated large hawk (Accipitridae sp.), the extirpated Burrowing Owl (*Athene cunicularia*), and the extinct nightjar *Siphonorhis americana* (Olson and Steadman, 1977, 1979). Only ten avian fossils were recovered from Marta Tick Cave. They represent at least five species, as follows: a manus phalanx of *Geotrygon versicolor* (Crested Quail Dove), a carpometacarpus of *Columba inornata* (Plain Pigeon), a tarsometatarsus of *Turdus aurantius* (White-chinned Thrush), a humerus of *Turdus jamaicensis* (White-eyed Thrush), a mandible of *Loxigilla violacea* (Greater Antillean Bullfinch), and five unidentified postcranial bones of passerines (a humerus the size of *Euneornis campestris*, a coracoid and two humeri the size of *Icterus leucopteryx*, and a carpometacarpus the size of *Spindalis zena*). Each of the five fossil species still occurs in the vicinity of the cave except *Columba inornata*, which we were unable to locate in April 1978 or June-November 1983.

Mammalian fossils from Marta Tick Cave consist of rodents and bats. The rodent material includes cranial and postcranial elements of the Jamaican cony, *Geocapromys browni*, a caviomorph rodent apparently now uncommon in the Cockpits, and bones of an extinct rice rat, *Oryzomys palustris*. Fossils of bats were present in limited numbers and, though not fully identified, most likely represent species currently inhabiting the cave and other nearby habitats (Table 4).

2. Modern Vertebrates

The amphibian fauna in the vicinity of Marta Tick Cave (Table 2), as discussed by Crombie (1977, 1986), consists of hylid and eleutherodactyline frogs. Of the former, *Osteopilus brunneus* was calling commonly from the forest canopy. *Eleutherodactylus cundalli* and *E. grabhami* were common on rocks and saplings, whereas *E. pantoni* was more abundant near the ground. There are two species of tiny leaf-litter frogs endemic to the area, *E. griphus* and *E. sisyphodemus*. Both were described by Crombie (1977, 1986) with *E. griphus*, based in part on material we obtained in 1983.

Four species of *Anolis* were collected near Marta Tick Cave (Table

2), but only *A. opalinus* and *A. lineatopus* were conspicuously present. But for a few leaf-litter geckos (*Sphaerodactylus goniorhynchus*), no ground-dwelling lizards were found in 1983.

We recorded 60 species of birds from the Quickstep region of the Cockpits (Table 3). Although many species that inhabit the primary forest also occur in second-growth forests, most of these species seldom or never nest in second-growth habitats, being dependent upon primary forest for long-term survival. The diversity of fruiting trees in the primary forest is exploited by various pigeons and doves (Davis et al., 1985) as well as parrots and thrushes, some of which also feed seasonally on fruiting trees in disturbed habitats. The avifauna of the primary forest region near Marta Tick Cave differs qualitatively from that of disturbed habitats near the Quickstep road. For example, primary forest species such as *Geotrygon versicolor*, *Columba caribaea*, *Vireo osburni*, and *Nesopsar nigerrimus* are absent or very rare near the road, whereas near the cave we never found *Zenaida aurita*, *Columbina passerina*, *Crotophaga ani*, *Anthracothorax mango*, *Tyrannus dominicensis*, *Mimus polyglottos*, or *Tiaris olivacea*. Before people cleared much of the forest along the Quickstep road, probably all of the species that prefer fields and/or second growth were uncommon or absent north of Quickstep village. North American migrant birds, in particular six species of parulid warblers, were absent from the Cockpits in June 1983, but comprised 14 of 48 birds netted during 22-25 November 1983.

Seven species of bats were collected within the study area, three of which were netted at the mouth of Marta Tick Cave (Table 4). *Pteronotus p. parnelli* was easily the most numerous of the cave residents.

3. Vegetation

The flora of the Cockpit Country is rich and includes a large proportion of endemic species, yet there are few published studies on the floristics and vegetation (Asprey and Robbins, 1953; Harvey et al., 1988; Kelly et al., 1988). In fact, there is no reliable list of vascular plants of the region, and important records undoubtedly await discovery. For example, in 1985 we found several fruiting trees that fit the description of *Ocotea martinicensis*, a species collected only once from Jamaica in 1907, and for which Adams (1972) found no other evidence of its occurrence on the island.

Marta Tick Cave is situated on a heavily forested, nearly vertical hillside. Within a 300 m radius of the cave we collected or identified 103 species of plants representing 45 families (Adams, 1972; Table 5). The forest is structured as a mature, closed canopy with a relatively sparse understory. Here and there are patches of second-growth trees with semi-open canopies. The height of the closed canopy ranges from 9 to 12 m with emergent species to 32 m. Among the predominate canopy species are *Oxandra lanceolata* ("Lancewood"), *Bauhinia divaricata* ("Moco john"), *Terminalia latifolia* ("Broadleaf"), *Nectandra antillana* ("Sweetwood"), *Micropholis rugosa* ("Beefwood"), *Trichilia* spp. ("Bloodwood"), and *Guarea swartzii* ("Mosswood"). Typical successional species consist of *Miconia rigida*, *M. laevigata* ("Johnny Berry"), *Piper amalago* ("Black giant"), *Eugenia* spp. ("Rodwood"), and *Fagara martinicensis* ("Prickly yellow"). Common vines include *Vitis tiliifolia* ("Water withe"), *Cissus*

sicyoides ("Pudding withe"), and *Syngonium auritum* ("Five finger"). Of ferns, *Thelypteris* spp. is common.

SUMMARY

Throughout the West Indies very few large tracts of undisturbed habitat remain. Thus, it is important to tabulate what we have learned about the flora and fauna of the Cockpit Country, a unique relict of West Indian forest habitat. As field biologists, we are heartened by those governments and policy makers who recognize that tropical biotas can no longer tolerate exploitation at the rate that has gone on during the past two centuries. That human encroachment is affecting the Cockpits as well can be seen in the differences between the avifauna near the village of Quickstep and the Quickstep Road versus that of the primary forest near the cave.

The fossil record of vertebrates from the West Indies has demonstrated how rapidly prehistoric human settlement of the islands can affect an indigenous flora or fauna (e.g., Steadman et al., 1984; Pregill et al., 1988). The fossil fauna from Marta Tick Cave did not reveal the antiquity or diversity of species that one would hope for in a glimpse of the late Pleistocene or early Holocene, thousands of years prior to human settlement of Jamaica. Yet the bones from Marta Tick Cave show that some elements of the vertebrate fauna have been lost in the past 100 years--giant diploglossines, *Ameiva* cf. *A. dorsalis*, *Leiocephalus* cf. *L. jamaicensis*, *Columba inornata*, and *Oryzomys palustris*. Whatever the causes, their disappearance underscores the delicate complexity of the Cockpit flora and fauna, about which much remains to be learned.

ACKNOWLEDGEMENTS

This project is one of several contributions from ongoing research in the Cockpit Country, begun by RIC in 1970 with a grant from the American Philosophical Society. For this present work we are, as always, grateful to the National Geographic Society for their support (grant #2482-82), encouragement, and patience. In Jamaica permits were obtained through the cooperation of Patrick Fairbairn of the Department of Natural Resources in Kingston. In the field we were privileged to have the able assistance and companionship of E. Dyer Moore and Richard Thomas. And as in prior and subsequent visits to the Cockpits, we owe continuing gratitude to Menocal Stephenson and his family of Quickstep. Their hospitality and tireless efforts on our behalf made this expedition possible. Their good cheer and company was always an uplift during the long hours of field work. This is contribution number 675 of the New York State Museum and Science Service.

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Table 1. Late Holocene Fossil Vertebrates from Marta Tick Cave, Trelawny Parish, Jamaica.

ANURA
- Hylidae
  - *Osteopilus brunneus*
  - *Hyla* spp.
- Leptodactylidae
  - *Eleutherodactylus* spp.

SAURIA
- Anguidae
  - *Celestus* cf. *C. occiduus*
  - *Celestus* species A
  - *Celestus* species B
- Gekkonidae
  - *Aristelliger* sp.
  - *Sphaerodactylus* sp.
- Polychridae
  - *Anolis* sp. A
  - *Anolis* sp. B
  - *Anolis* sp. C
- Tropiduridae
  - *Leiocephalus* cf. *L. jamaicensis*
- Teiidae
  - *Ameiva* cf. *A. dorsalis*

OPHIDIA
- Typhlopidae
  - *Typhlops* sp.
- Tropidophidae
  - *Tropidophus* cf. *T. haitianus*
- Colubridae
  - *Arrhyton* sp.

AVES
- Columbidae
  - *Geotrygon versicolor*
  - *Columba inornata*
- Turdidae (Muscicapidae)
  - *Turdus aurantius*
  - *Turdus jamaicensis*
- Fringillidae
  - *Loxigilla violacea*

MAMMALIA
- Chiroptera
  - ≥ three species
- Capromyidae
  - *Geocapromys browni*
- Cricetidae
  - *Oryzomys palustris*

Table 2. Amphibians and Reptiles of the Cockpit Country, Trelawny Parish, Jamaica.

* = forest species (i.e., resident but not necessarily restricted)
? = unconfirmed or distribution unclear

ANURA
- Bufonidae
  - *Bufo marinus* (margins only)
- Hylidae
  - * *Osteopilus brunneus*
  - * *O. crucialis*
  - * *O.* new sp.
  - * *Hyla marianae*
  - * *H. wilderi*
- Leptodactylidae
  - * *Eleutherodactylus cundalli* (semi-arboreal; also caves and rocks)
  - ? *E. fuscus* (paratype from Quickstep, but see Crombie [1986])
  - ? *E. gossei* (mostly margins, but some heard calling in Cockpits)
  - * *E. grabhami* (mostly petricolous)
  - * *E. griphus* (endemic to central Cockpits; leaf litter)
  - * *E. jamaicensis* (calling commonly in deep forest)
  - *E. johnstonei* (margins only)
  - * *E. junori* (crown lands of SE Cockpits)
  - *E. luteolus* (Quickstep road only; leaf litter)
  - * *E. pantoni* (leaf litter)
  - * *E. sisyphodemus* (endemic to central Cockpits; leaf litter)

SAURIA
- Gekkonidae
  - ? *Aristelliger praesignis* (peripheral)
  - *Sphaerodactlus argus* (Quickstep)
  - * *S. goniorhynchus*
  - ? * *S. oxyrhinus* (bromeliads)
  - ? * *S. semasiops* (endemic to cockpits; bromeliads)
- Polychridae
  - * *Anolis garmani*
  - *A. grahami* (Quickstep and margins)
  - * *A. "lineatopus"* (*A. l. neckeri*-like; possibly distinct)
  - * *A. opalinus*
  - *A. sagrei* (Quickstep and margins only)
  - *A. valencienni* (Quickstep)
- Anguidae
  - * *Celestus barbouri*
  - ? *C. crusculus*
  - ? *C. hewardi*
  - *C. fowleri* (Windsor endemic)

Table 2. Amphibians and Reptiles (Continued)

SERPENTES
- Typhlopidae
  - *Typhlops jamaicensis* (marginal, possible records near Windsor)
- Boiidae
  - * *Epicrates subflavus*
- Tropidophiidae
  - ? *Tropidophis haetianus*
- Colubridae
  - ? *Alsophis ater*
  - ? *Arrhyton funereus*

TESTUDINES
  - *Trachemys terrapen* (margins; in streams and rivers of western Cockpits, but probably also near Balaclava near S. edge)

Table 3. Birds of the Quickstep Region of the Cockpits, Jamaica, June and November 1983. Many fewer observations and collections were made in November than in June.

* = North American migrant; status based on November observations only
C = common (seen or heard virtually every day)
U = uncommon (seen or heard less than every day)
af = aerial soarer or feeder, generally above canopy
f = inhabits fields
pf = inhabits primary forest
sg = inhabits second-growth forest or edges of primary forest

Species	Common Name	Status
Cathartidae		
Cathartes aura	Turkey Vulture	C,af
Accipitridae		
Buteo jamaicensis	Red-tailed Hawk	U,af
Falconidae		
Falco sparverius	American Kestrel	U,af
Columbidae		
Zenaida aurita	Zenaida Dove	U,sg,f
Leptotila jamaicensis	White-bellied Dove	U,pf,sg
Geotrygon montana	Ruddy Quail Dove	C,pf,sg
Geotrygon versicolor	Crested Quail Dove	U,pf
Columba caribaea	Ring-tailed Pigeon	C,pf
Columba leucocephala	White-crowned Pigeon	U,sg
Columbina passerina	Common Ground Dove	C,f
Psittacidae		
Amazona collaria	Yellow-billed Parrot	C,pf
Amazona agilis	Black-billed Parrot	C,pf
Aratinga nana	Olive-throated Parakeet	C,pf,sg
Cuculidae		
Hyetornis pluvialis	Chestnut-bellied Cuckoo	C,pf,sg
Saurothera vetula	Jamaican Lizard Cuckoo	U,pf,sg
Crotophaga ani	Smooth-billed Ani	C,sg,f
Tytonidae		
Tyto alba	Common Barn-Owl	U,pf,sg,f
Strigidae		
Pseudoscops grammicus	Jamaican Owl	U,pf,sg
Caprimulgidae		
Chordeiles gundlachii	Antillean Nighthawk	U,af
Apodidae		
Streptoprocne zonaris	Collared Swift	U,af
Cypseloides niger	Black Swift	U,af
Tachornis phoenicobia	Antillean Palm Swift	U,af

Table 3. Birds of the Quickstep Region (Continued)

Species	Common Name	Status
Trochilidae		
Anthracothorax mango	Jamaican Mango	U,sg,f
Trochilis polytmus	Streamertail	C,pf,sg
Mellisuga minima	Vervain Hummingbird	U,pf,sg
Todidae		
Todus todus	Jamaican Tody	C,pf,sg
Picidae		
Melanerpes radiolatus	Jamaican Woodpecker	C,pf
Cotingidae		
Platypsaris niger	Jamaican Becard	U,pf,sg
Tyrannidae		
Tyrannus dominicensis	Gray Kingbird	U,f
Tyrannus caudifasciatus	Loggerhead Kingbird	C,sg
Myiarchus stolidus	Stolid Flycatcher	U,pf
Myiarchus barbirostris	Tom Fool	C,pf,sg
Myiarchus validus	Rufous-tailed Flycatcher	C,pf,sg
Contopus caribaeus	Greater Antillean Pewee	U,pf,sg
Myiopagis cotta	Yellow-crowned Elaenia	C,pf,sg
Hirundinidae		
Hirundo fulva	Cave Swallow	C,af
Corvidae		
Corvus jamaicensis	Jamaican Crow	C,af
Turdidae		
Turdus aurantius	White-chinned Thrush	C,pf,sg
Turdus jamaicensis	White-eyed Thrush	C,pf,sg
Myadestes genibarbis	Rufous-throated Solitaire	U,pf,sg
Vireonidae		
Vireo altiloquus	Black-whiskered Vireo	C,pf,sg
Vireo modestus	Jamaican White-eyed Vireo	C,sg
Vireo osburni	Blue Mountain Vireo	C,pf
Parulidae		
* *Mniotilta varia*	Black-and-White Warbler	C,pf,sg
* *Limnothlypis swainsonii*	Swainson's Warbler	U,pf,sg
* *Helmitheros vermivorus*	Worm-eating Warbler	C,pf
* *Dendroica caerulescens*	Black-throated Blue Warbler	C,pf,sg
Dendroica pharetra	Arrow-headed Warbler	C,pf,sg
* *Seiurus aurocapillus*	Ovenbird	C,pf,sg
* *Geothlpyis trichas*	Common Yellowthroat	C,sg
Coereba flaveola	Bananaquit	C,sg
Thraupidae		
Euphonia jamaica	Jamaican Euphonia	C,pf,sg
Spindalis zena	Stripe-headed Tanager	U,pf,sg

Table 3. Birds of the Quickstep Region (Continued)

Species	Common Name	Status
Icteridae		
Icterus leucopteryx	Jamaican Oriole	C,pf,sg
Nesopsar nigerrimus	Jamaican Blackbird	U,pf
Emberizidae		
Loxigilla violacea	Greater Antillean Bullfinch	C,pf,sg
Tiaris olivacea	Yellow-faced Grassquit	C,sg,f
Tiaris bicolor	Black-faced Grassquit	U,sg,f
Loxipasser anoxanthus	Yellow-shouldered Grassquit	C,sg,f
Euneornis campestris	Orangequit	C,pf,sg,f

Table 4. Bats Collected in the Vicinity of Marta Tick Cave, Trelawny Parish, Jamaica, June 1983.

† = endemic to Jamaica
‡ = netted at entrance of Marta Tick Cave

‡	*Pteronotus p. parnellii*	18
‡	*Mormoops blainvillii*	2
	Macrotus waterhousii jamaicensis	3
	Glossophaga soricina antillarum	11
‡	*Monophyllus r. redmani*	5
†	*Ariteus flavescens*	26
†	*Phyllonycteris aphylla*	6

Table 5. Common Woody Plants in the Vicinity of Marta Tick Cave, Trelawny Parish, Jamaica. Nomenclature follows Adams (1972). Common names were provided by Mr. Menocal Stephenson of Quickstep, Jamaica.

Species	Common Name
Smilacaceae	
Smilax balbisiana	Chainy root
Dioscoreaceae	
Dioscorea polygonoides	Bitter jessie
Dioscorea alata	Greater yam, Renta yam
Dioscorea rotundata	Guinea yam
Araceae	
Anthurium grandifolium	Wild coco
Philodendron scandens	
Philodendron lacerum	
Syngonium auritum	Five finger
Palmae	
Calyptronoma occidentalis	Long thatch
Piperaceae	
Piper amalago	Black giant
Piper hispidum	Brown giant
Pothomorphe umbellata	Cow foot
Moraceae	
Chlorophora tinctoria	Fustic tree
Trophis racemosa	Ramoon
Cecropia peltata	Trumpet
Ficus trigonata	Black fig
Ficus perforata	Red fig
Ficus maxima	White fig
Artocarpus altilis	Breadfruit
Urticaceae	
Boehmeria jamaicensis	Doctor Johnson
Polygonaceae	
Coccoloba tenuifolium	Wild grape
Coccoloba longifolia	Long leaved grape
Amaranthaceae	
Chamissoa altissima	Basket withe
Iresine diffusa	Jubba bush
Nyctaginaceae	
Neea nigricans	Saltwood
Pisonia aculeata	Cockspur
Guapira fragrans	Beefwood
Cactaceae	
Hylocereus triangularis	Okra
Annonaceae	
Xylopia muricata	Odorwood
Oxandra lanceolata	Lancewood

Table 5. Common Woody Plants (Continued)

Species	Common Name
Lauraceae	
Licaria triandra	Pepperleaf sweetwood
Nectandra antillana	Sweetwood
Nectandra patens	Capberry sweetwood
Nectandra coriacea	Fine leaved sweetwood
Ocotea leucoxylon	Sweetwood
Menispermaceae	
Hyperbaena prioriana	Beef bone
Theaceae	
Cleyera theaoides	Damson
Quiinaceae	
Quiina jamaicensis	Mountain bay
Clusiaceae	
Clusia flava	Card gum
Calophyllum calaba	Santa Maria
Mammea americana	Mammee
Papaveraceae	
Bocconia frutescens	Celandine
Rosaceae	
Prunus occidentalis	Prune
Prunus myrtifolia	Goatwood
Caesalpiniaceae	
Bauhinia divaricata	Moco John
Peltophorum linnaei	Braziletto
Haematoxylum campechianum	Nickal
Mimosaceae	
Pithecellobium arboreum	Tamarind
Papilionaceae	
Piscidia piscipula	Dogwood
Andira inermis	Wormwood
Flemingia strobilifera	Wild hops
Erythroxylaceae	
Erythroxylum confusum	Greenheart
Rutaceae	
Fagara martinicensis	Prickly yellow
Fagara elephantiasis	Yellow sanders
Fagara flavum	Walkerwood
Spathelia sorbifolia	Bernot
Simaroubaceae	
Picrasma excelsa	Bitterwood
Simarouba glauca	Bitter damson
Picramnia antidesma	Majoe bitter

Table 5. Common Woody Plants (Continued)

Species	Common Name
Meliaceae	
Cedrela odorata	West Indian cedar
Swietenia mahagoni	West Indian mahogany
Trichilia hirta	Wild mahogany
Trichilia moschata	Bloodwood
Guarea swartizii	Mosswood
Euphorbiaceae	
Drypetes ilicifolia	Rosewood (?)
Ricinus communis	Oil nut
Omphalea triandra	Pop nut
Sapium jamaicense	Blind eye
Anacardiaceae	
Mangifera indica	Mango
Comocladia pinnatifolia	Maiden plum
Sapindaceae	
Exothea paniculata	Wild guinep
Blighia sapida	Ackee
Maytayba apetala	Cobywood
Staphyleaceae	
Turpinia occidentalis	Drumwood
Rhamnaceae	
Rhamnus sphaerospermus	Cobo
Ziziphus chloroxylon	Wild cinnamon
Vitaceae	
Vitis tiliifolia	Water withe
Cissus sicyoides	Pudding withe
Malvaceae	
Hibiscus elatus	Mahoe
Hibiscus clypeatus	Congo mahoe
Bombacaceae	
Ceiba pentandra	Cotton tree
Flacourtiaceae	
Caesaria guianensis	Wild coffee
Bixaceae	
Bixa orellana	Anatto
Combretaceae	
Terminalia latifolia	Broadleaf
Myrtaceae	
Pimenta dioica	Pimento
Psidium guajava	Guava
Eugenia spp.	Rodwood
Syzygium malaccense	?

Table 5. Common Woody Plants (Continued)

Species	Common Name
Melastomataceae	
Miconia rigida	Johnny berry
Miconia impetiolaris	Bigleaf Johnny berry
Miconia laevigata	Johnny berry
Clidemia erythropogon	Wild Johnny berry
Sapotaceae	
Manilkara excisa	Sapodilla
Manilkara sideroxylon	Naseberry bullet
Micropholis rugosa	Beef apple
Pouteria multiflora	Galimenta
Verbenaceae	
Lantana camara	Sage
Solanaceae	
Solanum torvum	Gully bean
Solanum erianthum	Wild cucumber
Capsicum frutescens	Bird pepper
Rubiaceae	
Antirhea jamaicensis	Pigeonwood
Faramea occidentalis	Wild coffee
Compositae	
Eupatorium villosum	Bitter bush

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BY

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REEF ENVIRONMENT AND CORAL FAUNA OF SOUTHERN TAIWAN

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CHANG-FENG DAI

ABSTRACT

Southern Taiwan is surrounded by well-developed fringing reefs inhabited by a relatively rich coral fauna. The Taiwanese coral fauna is of considerable biogeographical interest since it borders the region with highest coral diversity. This report presents a description of the reef environment and a revised species checklist of both scleractinian and alcyonacean corals from southern Taiwan. 230 species representing 58 genera of scleractinian corals, 9 species of non-scleractinian reef-building corals, and 40 species of alcyonacean corals were recorded. Among them, 8 genera and 95 species of sclearactinian corals and 28 species of octocorals are new records. With regard to the scleractinian and alcyonacean fauna, southern Taiwan constitutes a part of the Indo-Pacific zoogeographical province and its species diversity is comparable to adjacent areas such as the Ryukyu Islands, Hainan Island, and Guam.

INTRODUCTION

Taiwan borders the region of the West Pacific Ocean with highest coral diversity, which lies between the Philippines and eastern Australia. Because of its central position, and because of the lack of main shallow water areas, Taiwan might be expected to act as a 'stepping stone' in the northward and eastward dispersal of shallow water organisms. A detailed knowledge of the Taiwanese reef fauna and flora will aid in understanding both biogeographical and dispersal questions concerning the western Pacific Ocean.

Although Taiwan lies near the northern latitudinal limit for the development of extensive fringing or barrier reef

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Institute of Oceanography, National Taiwan University,
P. O. Box 23-13, Taipei, Taiwan, R. O. C.

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systems, its sublittoral regions possess coral communities that rival many of those found in lower latitudes in diversity (Jones et al. 1972; Dai, 1988). The coral communities of Taiwan are distributed along the northern, eastern, and southern coasts and are lacking only on the western sandy coast. Other areas supporting coral communities are found at adjacent islands such as Lanyu (Orchid Island), Lutao (Green Island), Hsiao-Liuchiu, Penghu (The Pescadores) and a number of small offshore rocky islets (Fig. 1). Among these localities, southern Taiwan has the highest species diversity of corals.

Most previous work dealing with the Recent coral reefs of southern Taiwan has been in the form of species checklists compiled from scleractinian coral collections. Sugiyama (1937) reports 43 species and 24 genera from a coral collection made by Ehara in southern Taiwan. Kawaguti (1942, 1943) listed 78 species and 34 genera from Garanpi (Oluanpi) and compared the coral fauna there with other collections from Taiwanese waters. He also discussed the geographic distribution of corals along the Taiwanese coast and offshore islands. Later he (Kawaguti, 1953) revised the previous coral collections from Oluanpi and listed 87 species and 35 genera. Some publications by Ma (1957, 1958, 1959) reveal 26 coral species and 18 genera as being collected from Oluanpi. Jones et al. (1972) collected 340 coral specimens from the reefs of southern Taiwan and provided a list of 52 genera and 173 species, of which 121 are new to the study area. Subsequent investigations by Yang et al. (1976, 1977, 1982) increased the number to 245 species and 59 genera. However, most of these works only present a species checklist and a description of the coral fauna but include little systematic and ecological studies. Owing to the confused status of species at that time and the lack of prudent systematic studies, the species lists presented by the previous authors include numerous synonyms. Alcyonacean corals are among the most abundant benthic organisms on the fringing reefs of southern Taiwan, whereas they have rarely been given attention (Jones et al. 1972; Yang, 1985). Utinomi (1959) reported 15 species of alcyonaceans collected from tide-pools of southern Taiwan with the addition of very short descriptions. The species described by him were synonymized by Verseveldt (1980, 1982, 1983) into 11 species.

This report presents a brief description of the reef environment and a revised species checklist of both scleractinian and alcyonacean corals on the fringing reefs in southern Taiwan. Detailed taxonomic descriptions of the coral fauna have been published elsewhere (Dai, 1989, 1991; Hoeksema and Dai, 1991).

REEF ENVIRONMENT

GEOGRAPHY

Taiwan is located on the edge of a continental shelf and, hence, has affinities with continental landforms. To the east, the submarine topography drops steeply to 4000 m, and even to nearly 7000 m in the nearby Ryukyu Trench (Chu, 1971). Tectonically, Taiwan is situated in a continental-arc collision zone between the Asian Plate and the Philippine Sea Plate. The neotectonics of this island during the Holocene has been very evident by its substantial uplift, which may be greater than any other part of the world (Ho, 1975). The average uplift rate of the island has been estimated to range from 4.3 to 5.3 mm/yr (Peng et al. 1977).

The study area, i.e., Hengchun Peninsula, is located at the southern tip of Taiwan (21°55'-22°00'N., 120°40'- 120°52' E.). The peninsula is underlain mainly by Miocene rocks and capped with Pleistocene and Holocene sediments. The average uplift rate of the peninsula since 9000 yr b.p. is 5.3 mm/yr; however, the uplift rate has decreased to 2.5 mm/yr since 2000 yr b.p. (Peng et al. 1977). The high uplift rate of the study area may be partly responsible for the relatively narrow underwater fringing reefs in southern Taiwan. Raised coral reefs are scattered all over the peninsula and they form several levels of coastal terraces fringing the peninsula (Hanzawa, 1931). The prominent emergent reefs of the coastal area are continuations of the presently growing underwater coral reefs (Tsan, 1974).

CLIMATOLOGY

Taiwan is influenced by both continental and marine climates. The island lies partly in the tropics, with the Tropic of Cancer passing through the middle of the island. The tropical climate of southern Taiwan is characterized by marked seasonal variations in temperature and rainfall. Air temperatures are generally high, despite significant seasonal changes, with mean daily air temperature ranging from 20.1 in winter to 28.2 C in summer. Of the average annual rainfall (2200 mm), the majority (77 %) falls in the warmer months (June-September). The extreme seasonal variability of rainfall is evident from the long-term monthly mean rainfall record (Fig. 2). The strong seasonality of rainfall can impart localized seasonal changes in shallow inshore water turbidity and salinity as a consequence of terrigenous runoff.

The predominant winds of southern Taiwan are the seasonal monsoons. Two monsoon seasons are evident in southern

Taiwan, i.e., the northeast winter monsoon (October-April) and the southwest summer monsoon (May-September). Wind velocities are higher in winter and lower in summer with an annual average of 4.1 m/sec (Hsu, 1974). The unusually strong winter monsoon in the Hengchun area (known as "down-hill wind") has a speed of 10-17 m/sec (Hsu, 1974). Since the wind blows from NE to SW, the prevailing swell produced by this winter monsoon is strongest on the west side of Nanwan Bay.

The tropical location of southern Taiwan places it within the zone of typhoon disturbance. On average, the study area suffers direct hits (on typhoon tracks) by 1.17 typhoons per year. The high winds, high seas and generally intense rain accompanying such phenomena can cause considerable changes on reef morphology and coral communities (Stoddart, 1962, 1974; Woodley et al. 1982). Since typhoons that hit southern Taiwan usually blow from SE to NW, the west side of Nanwan Bay is exposed to the catastrophic damage of storms, whereas, the west coast of the Peninsula and the east side of Nanwan Bay are less exposed owing to the shielding by mountains.

OCEANOGRAPHIC SETTING

Several oceanographic survey programs have been conducted in southern Taiwan. Summarized below are data from four major sources: (1) a marine biological data acquisition program pertaining to the construction of a power plant at the west side of Nanwan Bay (Yang et al., 1976, 1977, 1982); (2) ecological surveys on the waters adjacent to the nuclear power plant (Hung et al., 1984); (3) ecological investigations on the waters of Kenting National Park area (Chang and Chen, 1986, 1987); and (4) continuously recorded unpublished data on water temperature and current of Nanwan Bay provided by the Radiation Laboratory of the Taiwan Power Company.

1. Water Temperature

Monthly average sea temperatures at 15 m deep (on reef surface) of southern Taiwan range from 22.5 to 28.2°C (Fig. 3). The variation in sea temperature is seasonal, with its high in summer (July-August) and low in the winter season (December-March), resulting in an annual range of 5-6°C. Differences in daily average sea temperature range from 20.3 to 29.2 °C. Diurnal variation is less than 5°C. Sea temperatures of southern Taiwan are relatively uniform in terms of different localities and depths.

2. Light and Water Turbidity

The average Secchi visibility depth for the reef waters of

Nanwan Bay was higher than 15 m in most areas, except in shallow waters in the northern part of the Bay (Hung et al., 1984). Light attenuation patterns through the water columns of Nanwan Bay (Yang et al. 1982) show that the relative light intensity at depths of 3-5 m varies widely (20-50 %) at different sites and the lowest occurs on the east side of Nanwan Bay. Relative light intensity usually falls below 20% at 20 m deep.

Turbidity caused by river discharge is heaviest on the east coast of the peninsula and at the east side of Nanwan Bay. Yang et al. (1982) reported that the turbidity measured at northeast side of Nanwan Bay three days after a heavy rainfall was 4.3 J.T.U. (Jackson Turbidity Unit), whereas the water turbidity of Nanwan Bay is usually 0.28-1.90 J.T.U.

3. Salinity and Nutrients

Annual variation of salinity measured in Nanwan Bay shows a regular annual pattern; ranging from 32.21-34.97 ppt with its maximum in winter (January-March) and minimum in summer (July-September). The distribution of salinity values is relatively uniform in both winter and summer season (Hung et al. 1984). During most seasons, the salinity is within the optimal range for hermatypic coral growth (34-36 ppt). River discharge has very limited effect on the salinity here.

Dissolved oxygen in the waters of southern Taiwan ranges from 3.77 to 5.10 ml/l. Usually the oxygen contents are highest in winter and lowest in summer. Seawater pH values in Nanwan Bay are relatively homogeneous and range from 7.84 to 8.34. Nutrients concentrations measured in the Bay were: nitrate (NO_3^--N), < 0.05 to 25.01 μM; nitrite (NO_2^--N), < 0.01 to 6.08 μM; phosphate (PO_4^{3-}-P), < 0.03 to 6.42 μM; silicate (-SiO_2^{2-}-Si), < 0.10 to 52.19 μM. BOD of the seawater ranges from 0.00 to 2.33 ± 0.29 ppm. The amount of total lipids ranges from 1.14 to 90.2 mg/l.

Related to concentrations of dissolved nutrients in other coral reef waters (Crossland, 1983), the concentrations of nitrate, nitrite and phosphate in southern Taiwan are unusually high.

4. Tides and Currents

The tidal regime of southern Taiwan is semidiurnal with a cycle of 12 hours and 25 minutes. Spring tides alternate regularly with neap tides. For Nanwan Bay, the mean spring tide range is 1.35 m and the mean neap tide range is 0.63 m. The tidal currents flow from east to west during flood tide and from west to east during ebb tide (Fig. 4). Hourly current recorded at Nanwan Bay shows prominent difference of

current speed between the west and northeast side of the bay (Fan and Yu, 1981). This difference is mainly due to the effect of bottom topography.

The inshore current of the west coast of Hengchun Peninsula flows from SSE to NNW during flood tide and from NNW to SSE during ebb tide with an average speed of 15 cm/sec (ranges from 2 to 53 cm/sec). The current speed on the northwest coast of the peninsula is relatively high indicating its high water energy environment. The relatively fast water flows of southern Taiwan are partly due to the strong Kuroshio current (Fan and Yu, 1981).

MATERIALS AND METHODS

SCLERACTINIAN FAUNA

Scleractinian specimens examined during this study are from three major sources: (1) the collections made by Jones et al. (1972) including a total of 340 coral specimens which are deposited at the Institute of Oceanography, National Taiwan University (TUIO), Taipei; (2) the collections made by Yang et al. (1976-1982) including about 1000 specimens and also deposited at TUIO, and (3) personal collections of the author made during several dives in 1981-1984 and 1985-87, with a total of about 500 specimens, of which representatives of species have been deposited at the Peabody Museum of Natural History, Yale University, New Haven, Connecticut, USA. Collections were made at sites throughout the fringing reefs of southern Taiwan (Fig. 1). The identification of the scleractinian species was carried out largely following the species concepts proposed by Veron and his co-workers (Veron and Pichon, 1976, 1979, 1982; Veron et al. 1977; Veron and Wallace, 1984; Hoeksema, 1989).

ALCYONACEAN FAUNA

Alcyonacean corals were also collected at stations as shown in Fig. 1. Whole colonies were collected if size permitted and otherwise a longitudinal slice (including capitula, stalk, and holdfast) was collected. Morphological characters of living colonies were recorded in situ and in addition underwater photos were taken. Specimens were placed in plastic bags labeled with codes corresponding to photographic tags.

The external morphology of polyps was examined with a dissecting microscope. Since different parts of an alcyonacean colony often contain different types of sclerites, four

sclerite preparations of a colony are prepared for identification, namely (1) surface layer of the capitulum or lobe, (2) interior part of the capitulum or lobe, (3) surface layer of the stalk, and (4) interior of the stalk. Sclerites were isolated by using a 20 % NaOH solution to disintegrate the tissues.

A total of about 220 alcyonacean specimens was examined. Species identifications were made using information published in Verseveldt (1980, 1982, 1983), Verseveldt and Alderslade (1982), Bayer (1981), and references cited therein. The specimens are deposited at the following institutions: (1) Peabody Museum of Natural History, Yale University, New Haven, USA; (2) Institute of Oceanography, Taiwan University, Taipei; and (3) Academia Sinica, Taipei, Taiwan.

RESULTS

SCLERACTINIA FAUNA

Table 1 presents a preliminary species list of scleractinian and non-scleractinian reef-building corals from the reefs of southern Taiwan. A review of previous records and the bathymetric distribution of each species are also given. A few species and genera listed by previous authors are omitted here; these have been reassigned to other taxa or have been synonymized.

In the present study, 230 species are recognized, representing 58 genera of scleractinian corals. Nine species of non-scleractinian reef-building corals including <u>Tubipora musica</u>, <u>Heliopora coerulea</u> and seven <u>Millepora</u> species are also listed here. Among them, 8 genera (<u>Plerogyra</u>, <u>Physogyra</u>, <u>Gardineroseris</u>, <u>Pectinia</u>, <u>Blastomussa</u>, <u>Caulastrea</u> and <u>Oxypora</u>), and 95 species of sclearactinian corals are new records. Most of the species assignments correspond to those by Veron and Pichon (1976, 1980, 1982), Veron et al. (1977), Veron and Wallace (1984), and Hoeksema (1989) for widespread species. Since the collecting effort in southern Taiwan is not very intense, there are likely to be some undiscovered scleractinian such as <u>Madracis</u>, <u>Physophyllia</u>, <u>Acrhelia</u>, and <u>Cynarina</u>. Additional species of particular genera such as <u>Acropora</u>, <u>Montipora</u>, and <u>Porites</u>, are also likely to be discovered since the traditional taxonomic difficulties related to these genera indicate that species may easily be overlooked. New species from deep water may similarly exist since depths greater than 35 m have rarely been studied in the study area. However, the majority of species found in southern Taiwan is included in Table 1.

ALCYONACEAN FAUNA

Table 2 lists the known shallow water alcyonacean species on the reefs of southern Taiwan. The list includes 40 species of which 28 are new records. Eight species do not conform to previous descriptions and remain unassigned.

Alcyonacean corals in southern Taiwan are mainly distributed in the areas around the two southernmost tips. The most extensive and abundant alcyonacean community was found at the west side of Nanwan Bay. This area is exposed to moderately strong currents and occasional storm surges. Alcyonaceans were rarely found on the protected reefs such as the east side of Nanwan Bay.

Although some species are common in tidal pools, alcyonaceans rarely appear in very shallow water (0-2 m) possibly due to their lack of a strong skeleton. However, they become common on deeper flat reef surfaces down to 5 m in depth. In this region, the soft corals are represented by large encrusting alcyonaceans such as *Sinularia exilis*, *S. facile*, and *Lobophytum pauciflorum*. Colonies of these species often reach 2 m in diameter or more. Alcyonaceans are abundant in intermediate waters of exposed reefs such as the submarine terrace and the reef front and occur in various shapes and colors. The most abundant species are: *Sarcophyton trocheliophorum*, *S. crassocaule*, and *Lobophytum sarcophytoides*. They usually form large stands of mushroom-like, bush-like or basin-like colonies. In deep waters, alcyonaceans are represented by small colonies of *Sarcophyton* spp. and *Sinularia* spp.

DISCUSSION

SCLERACTINIA FAUNA

With 61 genera and 235 species, the scleractinian fauna of southern Taiwan is very rich and is comparable to the richest areas in the west Pacific in terms of species diversity. Veron (1985) includes Taiwan in the 60 genera contour on the map of worldwide coral distributions. This study confirms his estimation, however, a significant decrease of species diversity from south to north on the island can be expected. Probably only southern Taiwan has such high species diversity.

Despite this high diversity, there are few coral species endemic for southern Taiwan, except *Fungia* (*Pleuractis*) *taiwanensis* (Hoeksema and Dai, 1991). The apparent small

degree of endemism is related to the fact that the fauna is of relatively recent origin and to the lack of geographical isolation of the island. By using radiocarbon methods, coral rocks collected from the seashore (1-2 m above sea level) around Hengchun Peninsula have been dated as 1300-1500 yr b.p. (Peng et al. 1977). These data indicate that the living reefs of southern Taiwan may be younger than 1500 years. The corals of southern Taiwan represent a newly colonized fauna; the prevailing northward current passing Taiwan, the Kuroshio Current, is responsible for colonization from the south. Southern Taiwan is located about 200 miles north of Luzon, and there is an additional series of small islets lying in between them. The Kuroshio current is a continuation of the North Equatorial Current which flows north from the central Philippines toward Taiwan at an average velocity of 1.0 knot (Nitani, 1972). Drift time from the Philippines to southern Taiwan is thus about eight days. Since coral larvae may remain in the plankton for a few weeks (Fadlallah, 1983; Richmond and Hunter, 1990), larvae from coral reefs of the Philippines and central Pacific Ocean can reach the waters of southern Taiwan and still have the ability to settle. Because of its close position to the Indo-Pacific scleractinian diversity center and because of its favorable environment, southern Taiwan thus has a very rich coral fauna despite its small reef area.

In addition, the scleractinian fauna in southern Taiwan may have a high species turnover rate. Catastrophic events such as typhoons and heavy sedimentation could be occurring frequently enough to cause local extinctions. Indeed, in spite of the fact that a large number of species was discovered during this study, other species reported by previous authors in the study area were not observed even under intense searching. The high recruitment rates with frequent disturbances seem to be the important factors in maintaining the species diversity of this fauna.

205 species (89%) recorded from southern Taiwan also occur on the Great Barrier Reef. Most of the species common to both regions do not show significant taxonomic differences. Similarly, Veron (1986) reported that 89% of the scleractinians recorded from Ishigaki I. also occur on the Great Barrier Reef. This indicates that the distribution of Indo-Pacific corals is generally homogeneous throughout the province at both generic and specific levels (Wells, 1969; Veron, 1985).

ALCYONACEAN FAUNA

The alcyonacean fauna of the study area is a part of the Indo-Pacific zoogeographical province. Most of the species

reported here are widely distributed in the province. The species diversity of alcyonacean fauna in southern Taiwan is comparable to the Ryukyu Islands (36 species; Utinomi, 1976, 1977a, b) and Hainan Island (18 species; Li, 1982). However, the major species reported in this study represent a relatively small proportion of species considered valid by Verseveldt (1980, 1982, 1983). For example, only 17% of Sinularia and Sarcophyton species and 13% of Lobophytum species are included in the alcyonacean species list.

The type locality of Asterospicularia laurae is in southern Taiwan (Utinomi, 1951) where it seems to have a restricted distribution, mainly in tide pools. The Xeniidae have been reported dominant in some reef environments in the Red Sea (Benayahu, 1985) and the central Great Barrier Reef (Dinesen, 1983), but they are relatively rare on the reefs of southern Taiwan. Several genera which have been reported abundant on some Indo-Pacific reefs, such as Litophyton, Lemnalia, Efflatounaria, and Capnella have not been recorded in the study area. Due to the systematic complexity of alcyonacean corals, their Indo-Pacific fauna is largely undescribed and hence it is premature to discuss their biogeography.

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Table 1. The known scleractinian and non-scleractinian reef-building corals on the fringing reefs of Southern Taiwan. Key to previous records, S: Yabe and Sugiyama (1935, 1936, 1941), Sugiyama (1937); K: Kawaguti (1942, 1943, 1953); M: Ma (1957, 1958, 1959); J: Jones *et al.* (1972); Y: Yang *et al.* (1976, 1977, 1982); R: Randall and Cheng (1984); H: Hoeksema and Dai (1991); N: synonymized from the above records. Distribution of coral species is based on collection records and field observation records from the following depths: A: recorded from 0-5 m; B: recorded from 5-15 m; C: recorded from 15-25 m. '*' indicates species not examined in this study because specimens were lost or not available.

Species	Previous record	Depth		
		A	B	C
CLASS ANTHOZOA				
SUBCLASS ZOANTHARIA				
ORDER SCLERACTINIA				
Family **ASTROCOENIIDAE**				
Stylocoeniella armata Ehrenberg	J,Y	+	+	
S. quentheri Bassett-Smith	J,Y	+	+	
Family **THAMNASTERIIDAE**				
Psammocora profundacellar Gardiner	K,Y	+		
P. digitata Edwards & Haime	N	+	+	
P. contigua (Esper)	K,Y	+	+	
P. brighami Vaughan *	K			
P. verrilli Vaughan *	K			
Famliy **POCILLOPORIDAE**				
Pocillopora damicornis Linnaeus	S,K,J,Y	+	+	
P. eydouxi Edwards & Haime	K,J,Y	+	+	+
P. meandrina (Dana)	S,K,J,Y	+	+	
P. verrucosa Ellis & Solander	K,J,Y	+	+	+
P. woodjonesi Vaughan		+	+	
Seriatopora caliendrum Ehrenberg	K,J,Y	+	+	
S. hystrix Dana	K,Y	+	+	
Stylophora pistillata (Esper)	K,J,Y			
Family **ACROPORIDAE**				
Acropora palifera (Lamarck)	K,J,Y	+		
A. cuneata (Dana)		+		
A. humilis (Dana)	K,J,Y	+	+	
A. gemmifera (Brook)		+		
A. monticulosa (Brugemann)	J,Y	+	+	
A. digitifera (Dana)	J,Y	+	+	+
A. glauca (Brook)	N	+	+	
A. robusta (Dana)	N	+	+	
A. palmerae Wells	J,Y	+		

Table 1. (continued).

Species	Previous record	Depth A	B	C
A. nobilis (Dana)	N	+	+	
A. grandis (Brook)	N	+	+	
A. formosa (Dana)	S,K,J,Y	+	+	+
A. valenciennesi (Edwards & Haime)	N		+	+
A. microphthalma (Verrill)	N	+	+	
A. aspera (Dana)	N	+	+	+
A. pulchra (Brook)	N		+	
A. millepora (Ehrenberg)	N	+	+	
A. tenuis (Dana)	Y	+	+	
A. dendrum (Basett-Smith)		+	+	
A. selago (Studer)	N		+	+
A. cytherea (Dana)	N	+	+	+
A. microclados (Ehrenberg)			+	
A. hyacinthus (Dana)	K,Y	+	+	
A. anthocercis (Brook)		+	+	
A. latistella (Brook)		+	+	
A. studeri (Brook)	S,K,Y	+	+	+
A. nana (Studer)	J,Y	+	+	+
A. azurea Veron and Wallace		+	+	
A. cerealis (Dana)	K,J,Y	+	+	+
A. nasuta (Dana)	J,Y	+	+	+
A. secale (Studer)			+	+
A. valida (Dana)	J,Y	+	+	+
A. clathrata (Brook)	N		+	
A. divaricata (Dana)		+	+	
A. florida (Dana)		+	+	
A. austera (Dana)			+	+
A. granulosa (Edwards & Haime)			+	+
A. acuminata Verrill	J,Y	+	+	
A. angulata (Quelch) *	K,Y			
A. sp 1		+	+	
A. sp 2		+		
Anacropora matthaii Pillai			+	
Astreopora myriophthalma (Lamarck)	J,Y	+	+	
A. listeri Bernard		+	+	
A. gracilis Bernard			+	
A. randalli Lamberts		+	+	
A. cucullata Lamberts			+	
A. suggesta Wells *	J,Y		+	
Montipora monasteriata (Forskal)	N	+	+	+
M. tuberculosa (Lamarck)			+	+
M. peltiformis Bernard	N	+	+	
M. turgescens Bernard		+		
M. spumosa (Lamarck)		+	+	
M. undata Bernard			+	+

Table 1. (continued).

Species	Previous record	Depth A	Depth B	Depth C
M. verrucosa (Lamarck)	K,J,Y	+	+	+
M. danae Edwards & Haime		+	+	
M. foveolata (Dana)	K,J,Y	+	+	
M. venosa (Ehrenberg)	J,Y	+		
M. angulata (Lamarck)			+	
M. digitata (Dana)	N		+	+
M. hispida (Dana)	J,Y	+	+	
M. efflorescens Bernard		+	+	
M. nodosa (Dana)		+	+	
M. grisea Bernard		+		
M. stellata Bernard	N	+	+	+
M. informis Bernard	K,J,Y	+	+	+
M. foliosa (Pallas)	S,M,K,J,Y	+	+	+
M. aequituberculata Bernard	N		+	+
M. incrassata (Dana)	N	+	+	
M. ehrenbergi Bernard	Y	+	+	
M. marshallensis Wells	J,Y	+	+	
M. lichen Dana	J,Y	+		
M. edwardsi Bernard	K,J,Y	+	+	
M. sp. 1		+	+	
M. sp. 2		+	+	
Family AGARICIIDAE				
Pavona clavus (Dana)	M,J,Y	+	+	+
P. divaricata Lamarck	K,Y		+	+
P. decussata Dana			+	+
P. cactus (Forskal)			+	+
P. maldivensis (Gardiner)	M,K,Y		+	
P. varians Verrill	J,Y	+	+	+
P. venosa (Ehrenberg)	J,Y	+	+	+
P. frondifera (Lamarck) *	S,K			
P. lilacea (Klunzinger) *	S,K			
P. gardineri Van der Horst *	S,K			
Gardineroseris planulata (Dana)	N	+	+	
Leptoseris hawaiiensis Vaughan	J,Y		+	+
L. incrustans (Quelch)	J,Y		+	+
L. explanata Yabe & Sugiyama			+	+
L. yabei (Pillai & Scheer)			+	+
L. tenuis Van der Horst				+
Coeloseris mayeri Vaughan	M,K,J,Y	+	+	
Pachyseris rugosa (Lamarck)	J,Y	+	+	+
P. speciosa (Dana)	K,J,Y		+	+

Table 1. (continued).

Species	Previous record	Depth A	Depth B	Depth C
Family SIDERASTREIDAE				
Coscinarea columna (Dana)	J,Y	+	+	
Family FUNGIIDAE				
Fungia (Cycloseris) sinensis (E. & H.)	H		+	+
F. (C.) cyclolites Lamarck	H		+	+
F. (C.) fragilis (Alcock)	H			+
F. (C.) costulata Ortmann	H			+
F. (C.) vaughani Boschma	H		+	+
F. (Verrillofungia) repanda Dana	H		+	+
F. (V.) concinna Verrill	H		+	+
F. (Danafungia) horrida Dana	H		+	+
F. (D.) scruposa Klunzinger	H		+	+
F. (Fungia) fungites (Linnaeus)	H		+	+
F. (Wellsofungia) granulosa Klünzinger	H			+
F. (Pleuractis) moluccensis V. d. Horst	H		+	
F. (P.) taiwanensis Hoeksema & Dai	H		+	
F. (P.) gravis Nemenzo	H		+	
F. (P.) paumotensis Stutchbury	H		+	+
F. (Lobactis) scutaria Lamarck	H		+	+
Ctenactis echinata (Pallas)	H			+
Herpolitha limax (Esper)	H		+	+
Polyphyllia talpina (Lamarck)	H		+	+
Sandalolitha robusta (Quelch)	H		+	+
S. dentata Quelch	H		+	+
Lithophyllon undulatum (Rehberg)	H	+	+	+
L. mokai Hoeksema	H		+	+
Podabacia crustacea (Pallas)	H		+	+
Family PORITIDAE				
Alveopora verrilliana Dana	J,Y	+	+	+
A. fenestrata (Lamarck)			+	
A. spongiosa Dana			+	
Goniopora lobata Edwards & Haime		+	+	
G. djiboutensis Vaughan		+	+	+

Table 1. (continued).

Species	Previous record	Depth A	Depth B	Depth C
G. minor Crossland		+	+	+
G. columna Dana			+	+
G. stuchburyi Wells			+	
G. tenella (Quelch)	J,Y	+	+	
Porites (Porites) australiensis Vaughan	J,Y	+	+	+
P. (P.) solida (Forskal)		+	+	
P. (P.) murrayensis Vaughan		+	+	
P. (P.) lichen Dana	J,Y	+	+	
P. (P.) lobata Dana	J,Y	+	+	+
P. (P.) lutea Edwards & Haime	J,Y	+	+	+
P. (P.) cylindrica Dana	N		+	+
P. (P.) nigrescens Dana	K,Y		+	
P. (P.) tenuis Verrill	J,Y	+	+	
P. (P.) annae Crossland		+	+	
P. (P.) stephensoni Crossland		+	+	
P. (P.) compressa Dana	J,Y	+	+	+
P. (P.) cocosensis Wells *	J,Y			
P. (Synaraea) rus (Forskal)	N	+	+	
P. (P.) sp.				
Family FAVIIDAE				
Cyphastrea chalcidicum (Forskal)	M,K,J,Y	+	+	
C. microphthalma (Lamarck)	J,Y	+	+	
C. serailia (Forskal)		+	+	
Caulastrea furcata Dana			+	+
Diploastrea heliopora (Lamarck)	K,J,Y		+	+
Echinipora lamellosa (Esper)	K,J,Y		+	+
Favia favus (Forskal)	J,Y	+	+	+
F. pallida (Dana)	J,Y	+	+	+
F. rotumana (Gardiner)	J,Y	+	+	+
F. speciosa (Dana)	S,M,K,J,Y	+	+	+
F. stelligera (Dana)	J,Y	+	+	+
F. laxa (Klunzinger)	Y	+	+	
F. maxima Veron, Pichon & Wijsman-Best			+	+
F. maritima Nemenzo			+	
Favites abdita (Ellis & Solander)	M,K,J,Y	+	+	+
F. chinensis (Verrill)	N	+	+	+
F. complanata (Ehrenberg)	K,Y		+	
F. rotundata Veron, Pichon & Wijsman-Best			+	+
F. flexuosa (Dana)	J,Y	+	+	+
F. russelli (Wells)		+	+	
F. pentagona (Esper)	M,J,Y	+	+	+

Table 1. (continued).

Species	Previous record	Depth A	Depth B	Depth C
F. halicora (Ehrenberg)	J,Y	+	+	
Barabattoia amicorum (Edwars & Haime)	N		+	
Montastrea valenciennesi (E. & H.)	N	+	+	
M. curta (Dana)		+	+	
Goniastrea australiensis (E. & H.)	N	+	+	+
G. edwardsi Chevalier	N	+	+	+
G. aspera (Verrill)	N	+	+	+
G. pectinata (Ehrenberg)	M,K,J,Y	+	+	+
G. retiformis (Lamarck)	K,J,Y	+	+	+
Hydnophora exesa (Pallas)	J,Y	+	+	+
H. microconos (Lamarck)	K	+	+	
H. rigida (Dana)	J,Y		+	+
Leptoria phrygia (Ellis & Solander)	M,K,J,Y	+	+	+
Oulophyllia crispa (Lamarck)	M,J,Y		+	+
Platygyra pini Chevalier		+	+	+
P. lamellina (Ehrenberg)	M,K,J,Y	+	+	+
P. daedalea (Ellis & Solander)	N	+	+	+
P. sinensis (Edwards & Haime)	N	+	+	+
Plesiastrea versipora (Lamarck)	M,K,J,Y	+	+	+
Leptastrea purpurea (Dana)	M,K,J,Y	+	+	+
L. pruinosa Crossland	J,Y	+	+	
L. transversa Klunzinger		+	+	
Family OCULINIDAE				
Galaxea fascicularis (Linnaeus)	K,J,Y	+	+	
G. cf. astreata (Lamarck)		+	+	
Simplastrea versicularis Umbgrove	J,Y		+	
Family MERULINIDAE				
Merulina ampliata (Ellis & Solander)	K,J,Y	+	+	+
Scapophyllia cylindrica (E. & H.)	J,Y		+	+
Family PECTINIIDAE				
Echinophyllia asper (Ellis & Solander)	K,J,Y		+	+
Oxypora lacera (Verrill)			+	+
O. glabra Nemenzo			+	+

Table 1. (continued).

Species	Previous record	Depth A	B	C
Mycedium elephantotus (Pallas)	N		+	+
Pectinia lactuca (Pallas)			+	+
P. paeonia (Dana)			+	+
Family **MUSSIDAE**				
Blastomussa sp.			+	
Scolymia cf. vitiensis Bruggemann				+
Acanthastrea echinata (Dana)	M,K,J,Y	+	+	+
A. hillai Wells		+	+	
Lobophyllia hemprichii (Ehrenberg)	M,K,Y		+	+
L. corymbosa (Forskal)	K,J,Y		+	+
L. hataii Yabe, Sugiyama & Eguchi			+	
Symphyllia recta (Dana)	M,K,J,Y	+	+	+
S. radians Edwards & Haime			+	+
S. agaricia Edwards & Haime	M,K,J,Y		+	+
S. cf. valenciennesii Edwards & Haime			+	+
Family CARYOPHYLLIIDAE				
Euphyllia (E.) glabrescens C. & E.	K,J,Y	+	+	
E. (E.) cristata Chevalier			+	
E. (Fimbryaphyllia) ancora V. & P.	N	+	+	
Plerogyra sinuosa (Dana)			+	+
Physogyra lichtensteini (E. & H.)			+	+
Family DENDROPHYLLIIDAE				
Turbinaria peltata (Esper)	K,J,Y		+	+
T. frondens (Dana)	N		+	+
T. mesenterina (Lamarck)	N		+	+
T. reniformis Bernard			+	+
T. immersa Yabe & Sugiyama	J,Y		+	+
Tubastrea aurea Quoy & Gaimard	J,Y		+	+
Dendrophyllia micranthus (Ehrenberg)				+
SUBCLASS OCTOCORALLIA				
ORDER COENOTHECALIA				
Family HELIOPORIDAE				
Heliopora coerulea (Pallas)	K,J,Y	+	+	+

Table 1. (continued).

Species	Previous record	Depth A	B	C
ORDER STOLONIFERA				
Family TUBIPORIDAE				
Tubipora musica Linnaeus	K,J,Y	+	+	
CLASS HYDROZOA				
ORDER MILLEPORINA				
Family MILLEPORIDAE				
Millepora platyphylla H. & E.	K,J,Y,R	+	+	
M. dichotoma Forskal	R	+	+	
M. tenera Boschma	K,J,Y,R	+	+	
M. murrayi Quelch	K,J,R	+	+	
M. intricata Edwards & Haime	J,Y,R	+	+	
M. foveolata Crossland	R	+	+	
M. tuberosa Boschma	R	+	+	

Table 2. A list of alcyonacean corals known from the fringing reefs of Southern Taiwan. '*' indicates the species reported by Utinomi (1959). Distribution of coral species is based on collection records and field observation records from the following depths, A: recorded from 0-5 m; B: recorded from 5-15 m; C: recorded from 15-25 m.

species	Depth		
	A	B	C
CLASS ANTHOZOA			
SUBCLASS OCTOCORALLIA			
ORDER ALCYONACEA			
Family ALCYONIIDAE			
Alcyonium simplex Thomson and Dean	+	+	
A. molle Thomson and Dean	+	+	
A. rotundum Thomson and Dean	+	+	
Sinularia densa (Whitelegge)	+	+	+
S. exilis Tixier-Durivault	+	+	
S. facile Tixier-Durivault	+	+	
S. flexibilis (Quoy & Gaimard)		+	+
S. gibberosa Tixier-Durivault		+	+
S. grandilobata Verseveldt		+	+
S. granosa Tixier-Durivault	+	+	+
S. halversoni Verseveldt		+	
S. inexplicita Tixier-Durivault		+	
S. lochmodes Kolonko		+	+
S. mayi Lüttschwager *		+	
S. mollis Kolonko		+	
S. muralis May		+	+
S. numerosa Tixier-Durivault	+	+	+
S. polydactyla (Ehrenberg) *	+	+	+
S. scabra Tixier-Durivault	+	+	+
S. sp. 1		+	
S. sp. 2		+	
Lobophytum batarum Moser	+	+	
L. crassum Von Marenzeller	+	+	+
L. mirabile Tixier-Durivault		+	+
L. pauciflorum (Ehrenberg)	+	+	+
L. sarcophytoides Moser		+	+
L. solidum Tixier-Durivault		+	
L. sp.		+	
Sarcophyton crassocaule Moser	+	+	+
S. ehrenbergi Von Marenzeller *		+	+
S. glaucum (Quoy & Gaimard)	+	+	+
S. stellatum Kükenthal		+	
S. tortuosum Tixier-Durivault		+	
S. trocheliophorum Von Marenzeller *	+	+	+
S. sp. 1		+	

Table 2. (continued)

species	Depth A	Depth B	Depth C
S. sp. 2		+	
Cladiella sphaerophora (Ehrenberg) *		+	
C. pachyclados (Klunzinger) *		+	
C. sp.		+	
Family **NEPHTHEIDAE**			
Nephthea erecta Kükenthal *		+	+
N. chabroli Audouin		+	+
Paralemnalia thyrsoides (Ehrenberg) *	+		
Family **XENIIDAE**			
Anthelia formosana Utinomi *	+	+	
Heteroxenia elisabethae Kölliker *	+	+	
H. sp.		+	
Cespitularia stolonifera Gohar *	+		
Family **ASTEROSPICULARIIDAE**			
Asterospicularia laurae Utinomi	+		

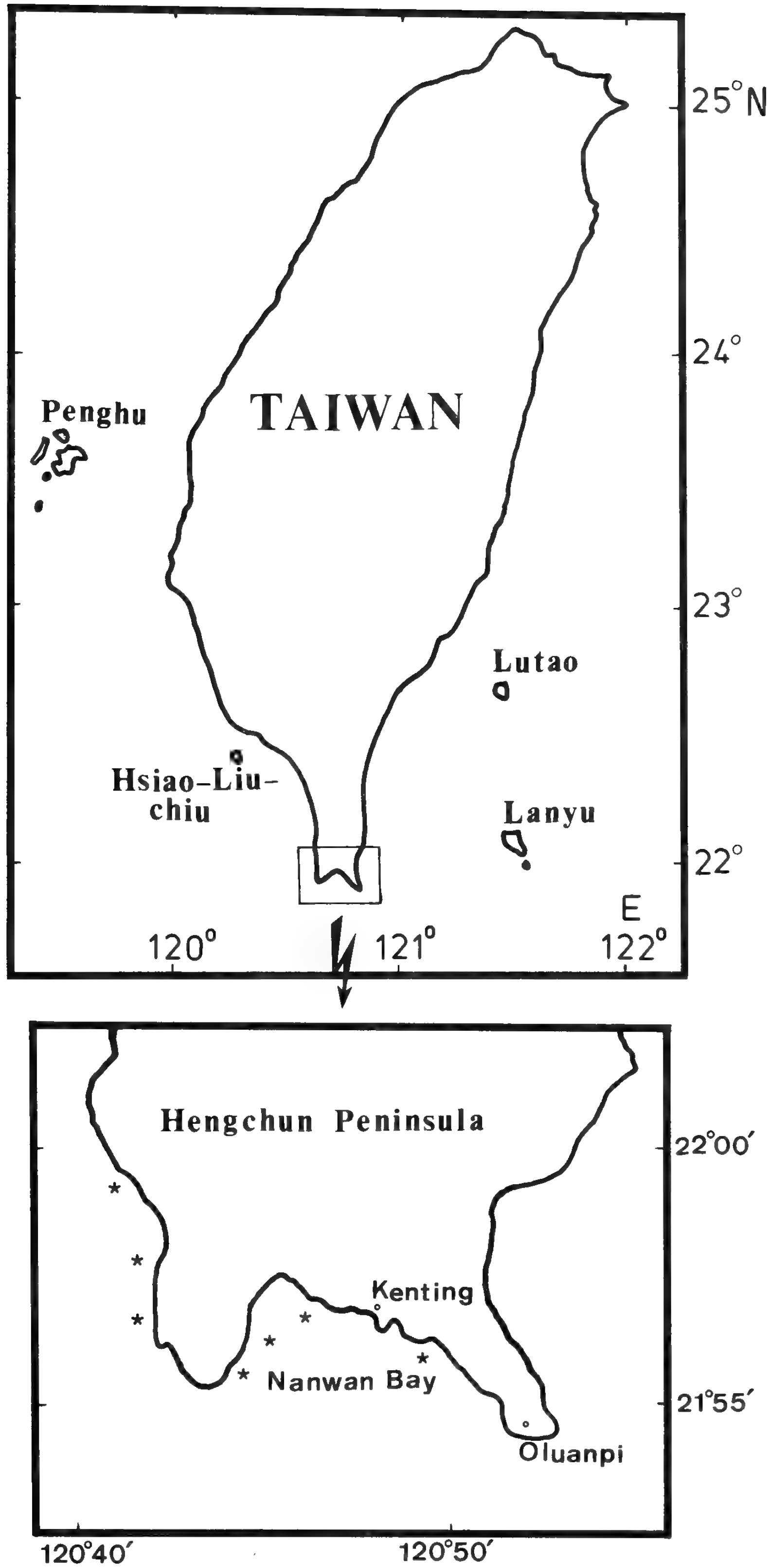

Fig. 1. Map of Taiwan and the study area. "*" indicates the study sites.

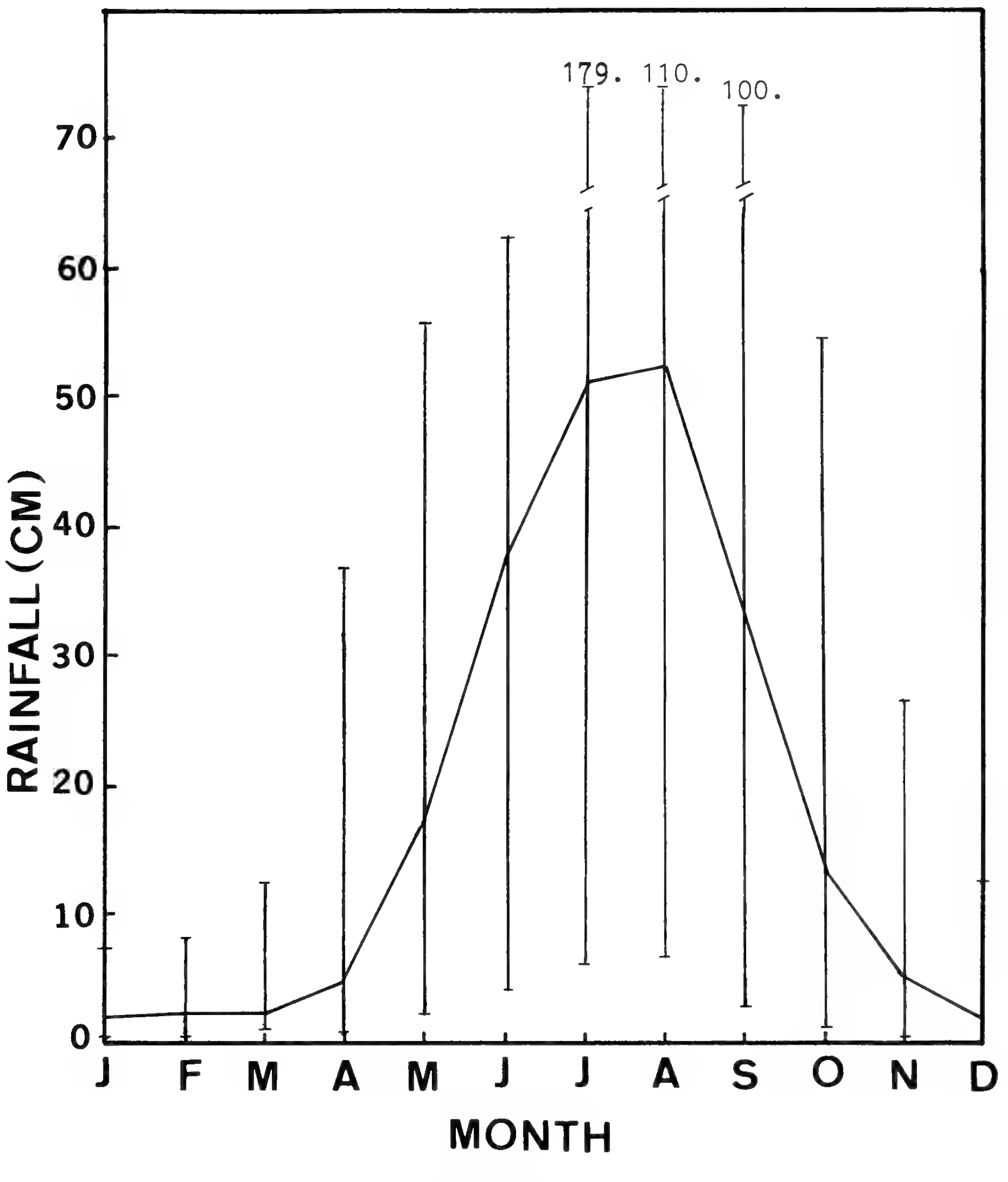

Fig. 2. Seasonal variation of monthly mean rainfall from 1900 to 1985 in southern Taiwan. Ranges are shown in bars. (Data from Hengchun Weather Station, Central Weather Bureau, R. O. C.)

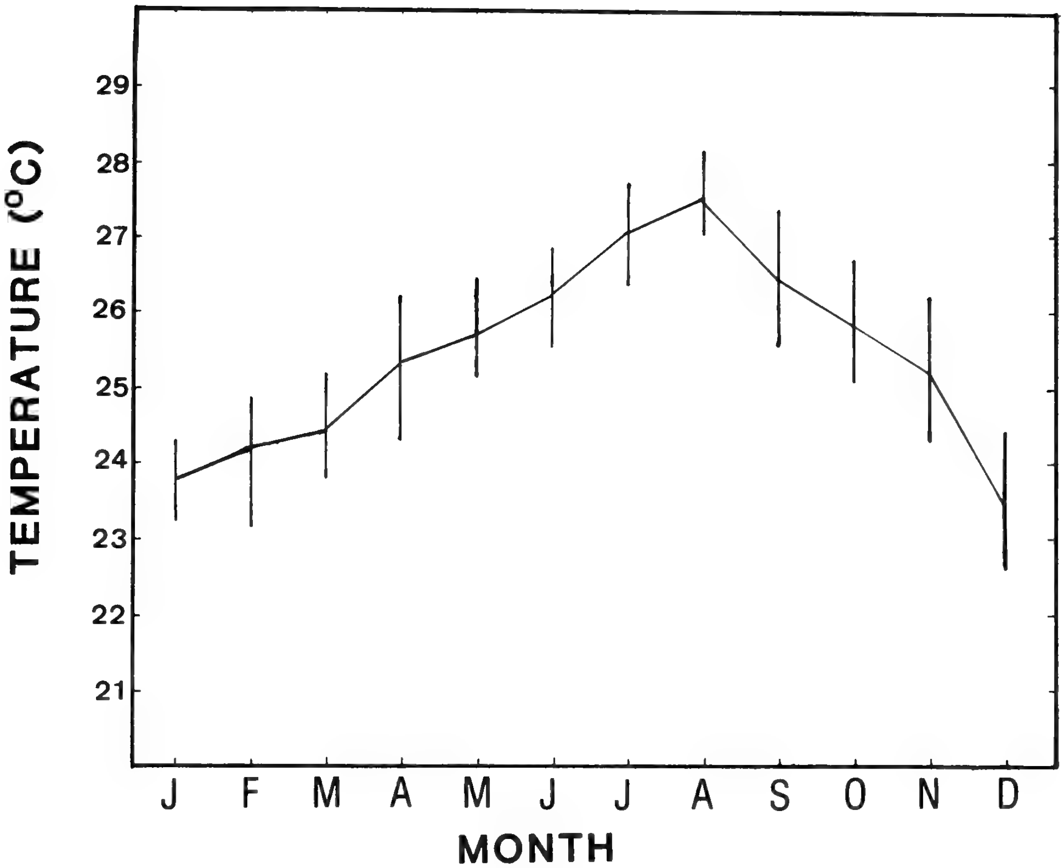

Fig. 3. Seasonal variation of monthly mean sea temperature in 15 m deep in Nanwan Bay from 1980-1988. (Data from the Radiation Laboratory, Taiwan Power Company, R. O. C.).

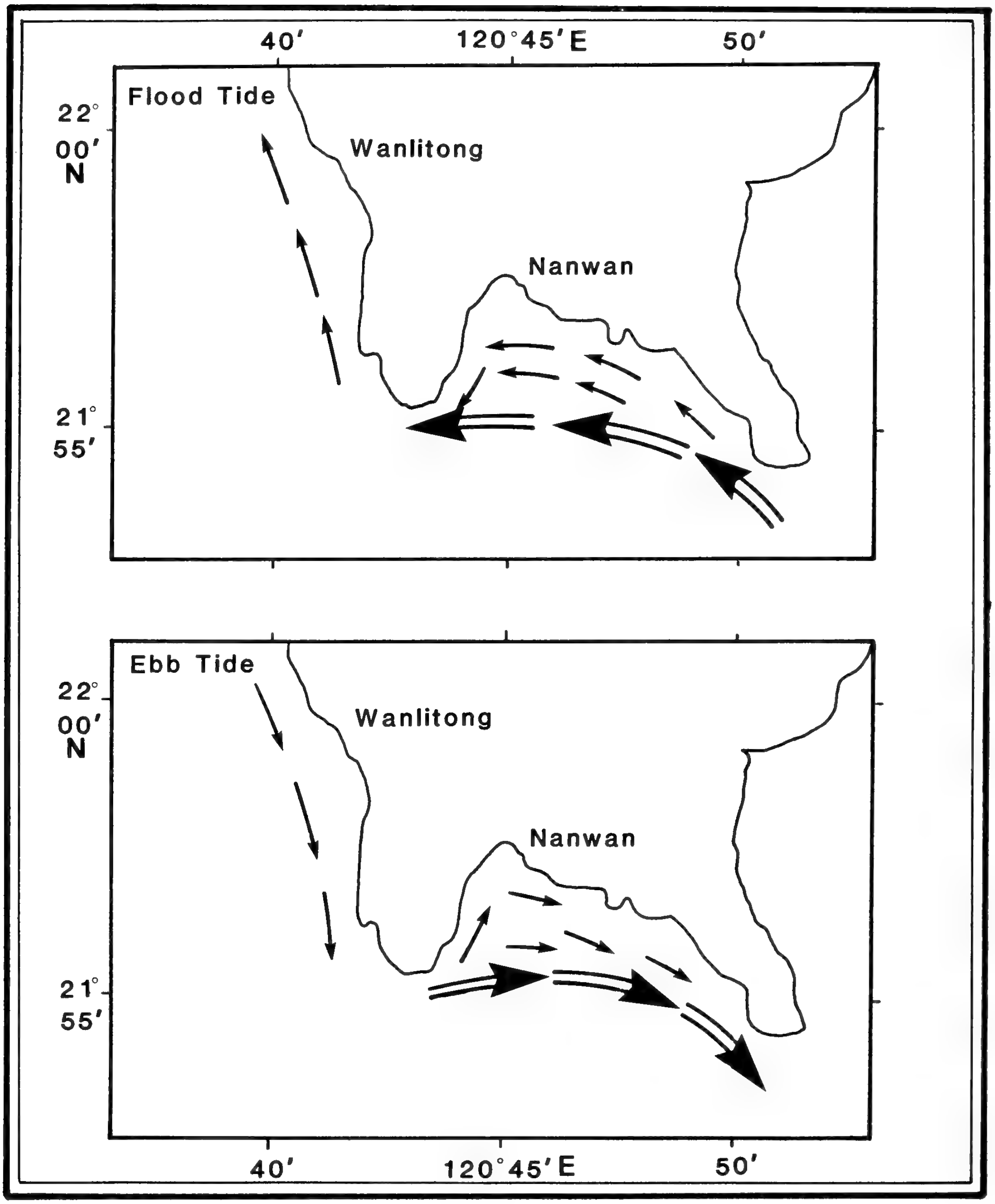

Fig. 4. Flow pattern of coastal waters in southern Taiwan during flood and ebb tides. (Redrawn from Hung et al. 1984 and Chang and Chen, 1987).

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